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YOUR COMPUTER

AUGUST 1982 Vol.2 No.8

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Dragon reviewed

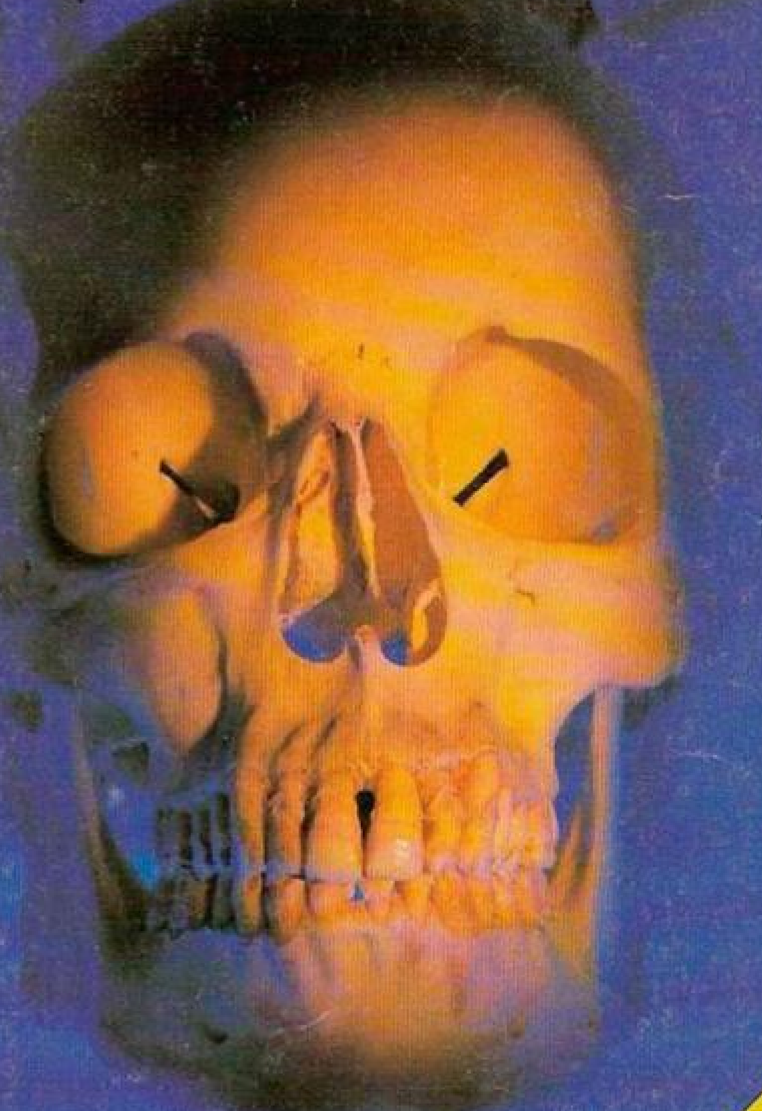
Vic duck shoot

BBC techniques

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Atom file handling

Ecological modelling

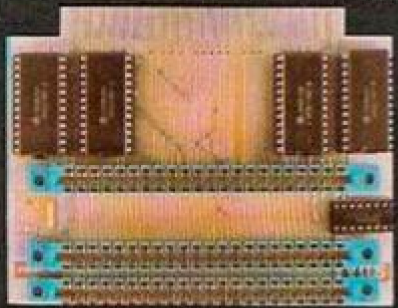


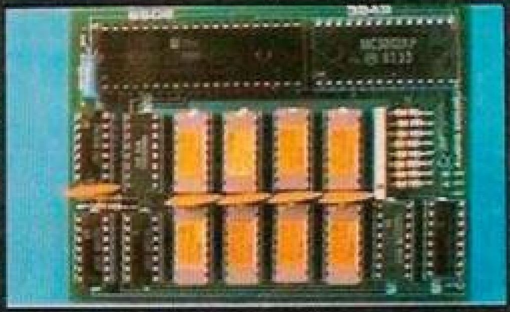
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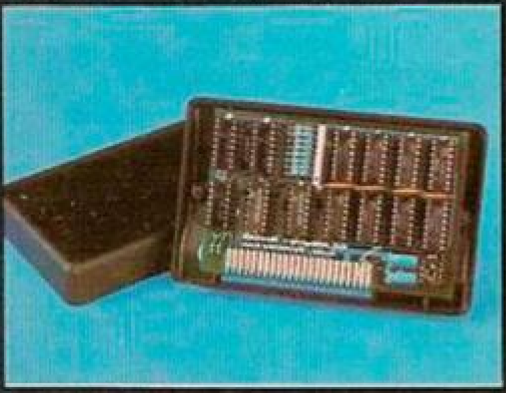


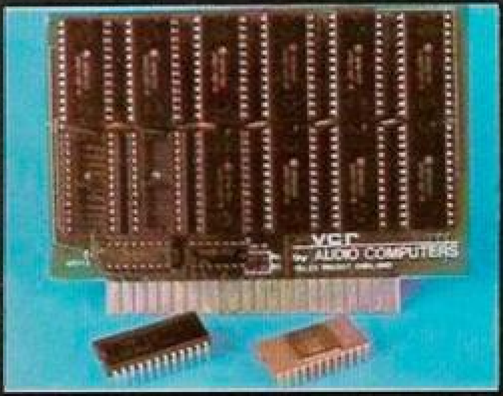


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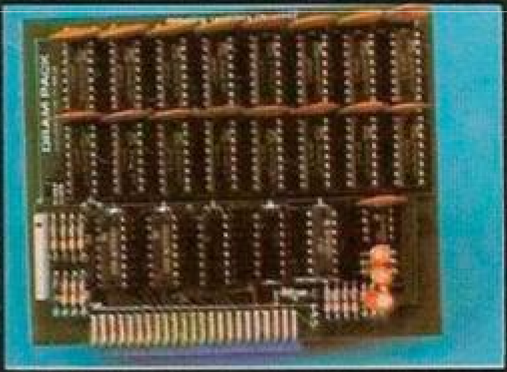


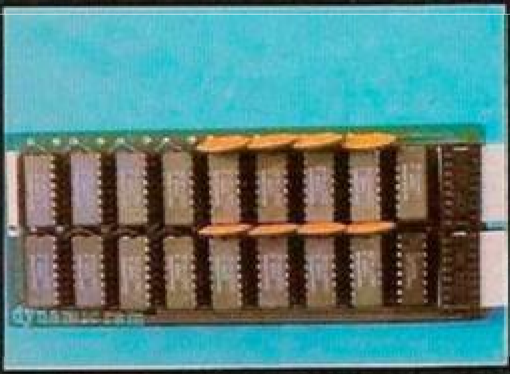
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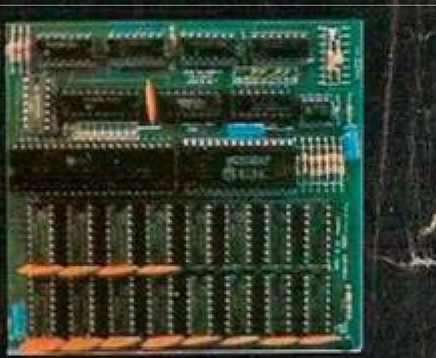
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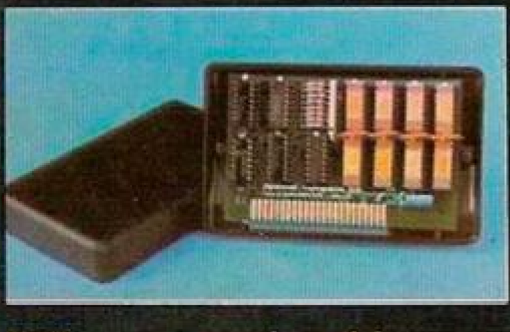




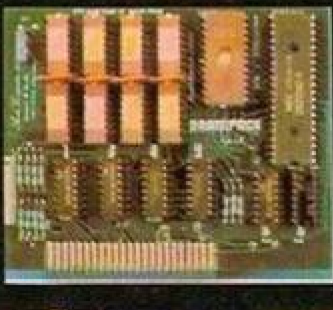
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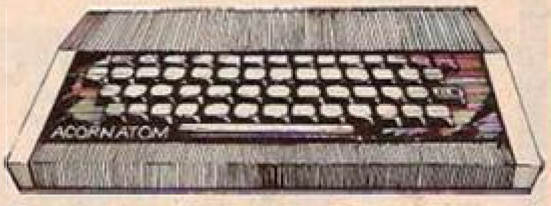
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EDITORIAL

IN A CRUEL WORLD where peripherals such as printers and disc drives appeared to be the prerogative of only the big-spender, networking micros together to share such costly resources made sound economic sense. But now that colour micros complete with high-resolution graphics, printers and adequate storage will soon be available for less than £200, a question mark hangs over the future of "the network". Yet for major firms such as Sinclair Research and Acorn, their machines' potential to be networked is still considered important enough to figure prominently in their sales literature. This is obviously intended as an extra enticement, particularly to the educational market where spending cuts make austerity the rule and networking an attractive way round it.

Clearly then, given the recent falls in hardware prices, one might be forgiven for believing that networks are an outmoded idea. In reality, however, they are a good instance of a solution to a problem leading technology down a path it might not otherwise have taken — a path which leads to unexpected benefits as often as it leads to wasted time and money. Local-area networks have been the traditional domain of the low-cost micro. Now communication between more remotely-located machines should become an affordable prospect. An amateur group in Montreal has even formed a network linked by citizens' band radio.

In the States bulletin-board networks are becoming commonplace. With this kind of system you use your machine as a communications medium through which you can send and receive messages from fellow users. Networks will enable home computers to be used for tasks other than purely computing. Cheaper Modems bring in their train less expensive Prestel adaptors which in turn lead us to telesoftware and the advantages of being able to access large and remote databases with a small machine. Sinclair Research, with its sights set firmly on the software market, believes that its proposed £20 Prestel adaptor for the Spectrum will make downloading software directly from a Sinclair database the norm, and software piracy and distribution a thing of the past.

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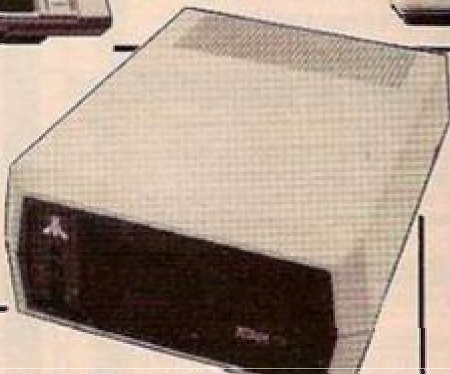


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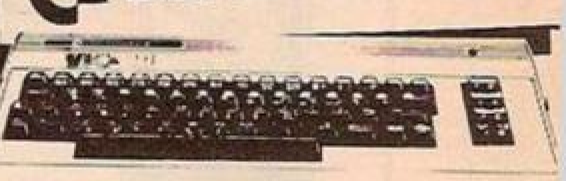
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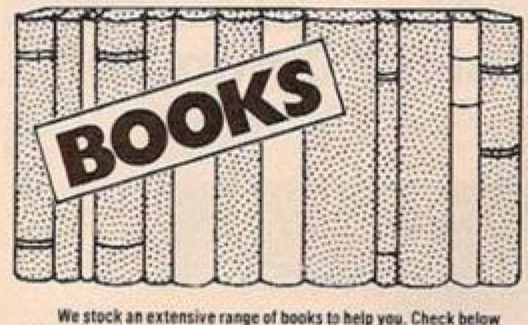
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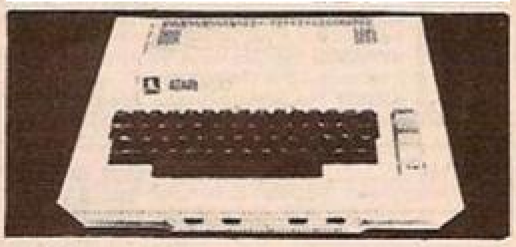
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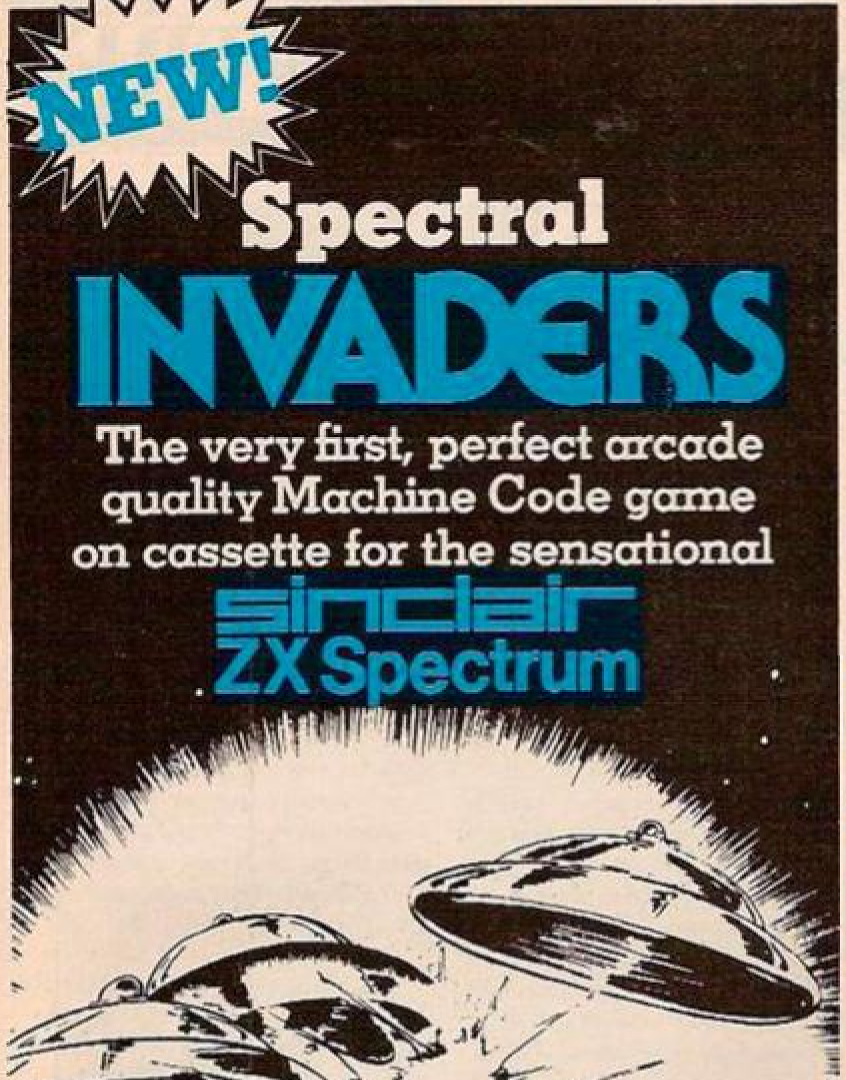
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FLEXIDISC FAN

Congratulations on your far-seeing flexidisc experiment; I hope we are to see many more. Here are a few notes on my own findings when attempting to Load the program.

First, being flexible, the disc tended to distort and slip on the normal turntable. This gave a variable frequency signal which can cause problems with the internal clock on the computer. This was easily overcome by Cellotaping the flexidisc to a thicker backing and further Cellotaping the assembly to the turntable. The method of transferring disc to tape was then used and immediately problems became apparent with the automatic level control on one type of music centre.

The signal was far too weak on playback and Loading unsuccessful. Changing to a stereo recorder having a VU meter with a range 0 to 6, and experimenting with different levels showed that level 3, i.e., the middle of the range, gave the best results.

A clear undistorted recording on TDK tape loaded successfully and back-up copies on C12 were made immediately utilising the cheap tape recorder normally used with the computer. The game itself is good fun to play and, as yet, unbeaten.

G L Smith,
Slough,
Berkshire.

FAIR PRESS?

As far as I am aware, Eric Deeson has not published the parameters by which he judges software. Perhaps he should include that information with every review. I accept that a large part of his reviews will be an expression of his personal opinion, and that certain elements must be a purely personal view, and cannot be quantified against a given scale, for example, format or screen layout, quality of graphics and novelty.

However, the quality of a pre-recorded tape is one factor which can be more accurately assessed, and I feel that Deeson's approach to this element of his reviews may require some modification. In the May review, Deeson writes: "A tape recorder for £18.50 from G J Henderson . . . is the Hong Kong-made Duette, which had the task of loading all the programs for this review . . .".

In view of the known problems of the compatibility of cassette machines with the ZX-81, is it a fair test of ZX-81 software to use only one cassette machine, and to condemn all of a company's software if a sample fails on that particular machine? The two tapes from my company which he believed to be unloadable were checked by five independent exhibitors at the ZX Microfair in Manchester and were loaded successfully by them.

Perhaps the quality of the recording on the tape should be evaluated electronically, and if the tape fails to load on one machine, others should be tried.

Surely the main purpose of a software review is to impart information about a program to the buying public, which they would only be able to obtain themselves by buying the product. On this basis, I believe that a reviewer should persevere until he successfully loads a program, and can fulfil his main aim, and if that requires him returning tapes to a supplier for replacement, he should do so.

Martin Ridout,
Picturesque,
West Wickham,
Kent.

NO GUARANTEE

No doubt as in common with many other readers of your magazine, I purchased a full-size keyboard for my ZX-81. I removed the computer board from its casing and fixed it lovingly into my new keyboard. Away I went, fingers dashing all over the keyboard, everything was rosy.

Then one day my ZX-81 developed a fault; not to worry, it was "fully" guaranteed — or so I thought. According to Sinclair Research, I had invalidated my guarantee by opening and removing the computer board from its casing and it would cost me a minimum of £20 to have it repaired.

So to all those who have, or are contemplating purchasing a keyboard, you have or will have thrown away your "fully comprehensive" guarantee.

P J Shaw,
Reading,
Berkshire.

PURE ARTISTRY

The Pure Artistry program by John Marshall, *Your Computer* June, does have one disadvantage. Everywhere the spot goes it draws a line. Using the space bar in conjunction with the arrow keys produces a new set of values for Z and can be used to move the spot without drawing a line, or to erase a line already drawn.

The change makes use of the Reset command to darken the position behind the moving spot. Line 50 is not required. Lines 60, 70, 80 and 110 should be modified to Else 66, 76, 86 and 116 respectively.

The following new lines are required:

```
66 IF Z=136 THEN 67 ELSE 70
67 Y=Y-1: GOSUB 200
68 RESET (X, Y+1): GOTO 30
76 IF Z=144 THEN 77 ELSE 80
77 Y=Y+1: GOSUB 200
78 RESET (X, Y-1): GOTO 30
86 IF Z=160 THEN 87 ELSE 90
87 X=X-1: GOSUB 200
88 RESET (X+1, Y): GOTO 30
116 IF Z=192 THEN 117 ELSE 120
117 X=X+1: GOSUB 200
118 RESET (X-1, Y): GOTO 30
200 IF X<0 THEN X=X+1 ELSE IF
    X>127 THEN X=X-1
210 IF Y<0 THEN Y=Y+1 ELSE IF
    Y>47 THEN Y=Y-1
220 RETURN
```

The values of Z for diagonal movement are 168, 200, 208 and 176. This can easily be incorporated into the program if required.

K J Maris,
Cotgrave,
Nottingham.

PET TO VIC

Many people will have experienced the frustrating fact that Pet-produced data tapes will load on the Vic but not vice-versa. This can be remedied by the following procedure.

Before loading the program type the following, which is for the standard 5K Vic.

```
POKE 4096,0
POKE 41,16
CLR
```

For a Vic with 16K expansion type:

```
POKE 4608,0
POKE 40,1
POKE 41,18
CLR
```

I can assure you this method works as I have been using it for months without fail.

T Wilson,
Preston,
Lancashire.

BBC TIPS

Here are some discoveries I made using my newly-acquired BBC model A, which are not in the manual.

Peek and Poke are virtually redundant on the BBC Micro except for screen control. To find the character number of a character on the screen use:

```
PRINT ?(HIMEM+X+Y*40)
```

where X equals the number of columns across and Y the lines down. To Poke the screen with, say, a 2 use:

```
?(HIMEM+X+Y*40)=ASC"2"
```

Notice the equals sign instead of the usual comma. In Mode 7 (teletext) only a black and white text is apparently available. However, there are in fact six other colours, chunky graphics, double-height and flashing characters. To obtain the colours, you must Print a control character by using

```
PRINT CHR$(X)
```

or

```
VDU X:PRINT;
```

These codes are: 129, red; 130, green; 131, yellow; 132, blue; 133, magneta and 134, cyan. For instance:

```
PRINT CHR$(134);"Mark Stephens"
```

would print the name in cyan.

For chunky teletext graphics, add 16 to the colour code that you want. Chunky graphics replace numbers, lower-case letters, and some symbols:

```
PRINT CHR$(150);"55"
```

would print two cyan rectangular graphics. For flashing letters:

```
PRINT CHR$(136);
```

To obtain double-height characters:

```
PRINT CHR$(141);"Your Computer":
PRINT CHR$(141);"Your Computer"
```

will print *Your Computer* in double-height characters.

Mark Stephens,
Portsmouth,
Hampshire.

VOYAGER ERRORS

There are two errors in Voyager Views in the July issue on page 82:

```
170 PLOT 6, SIN(RAD(Y+INC))
    ×+M, etc
120 FOR X=R*1.2 TO R*2.5 STEP
    R*0.06
```

These faults are by no means obvious, and they stop the program giving meaningful results. Also, how about a bit of colour? For example

```
50 VDU 19,1,0,0,0,0
110 VDU 19,1,3,0,0,0
```

will give yellow on a black background.

A S Day,
Fetcham,
Surrey.

TRANSFER CODE

In the June 1982 issue you published a program by Nick Godwin for transferring machine-code from Rem to RAMtop. It seemed to require about 1.5K. This program is 24 bytes long and does the job about 100 times faster. I am assuming that RAMtop has been Poked with 124 — that is, Poke 16389,124.

```
01        LD BC
14,00     Number of bytes to be
          transferred
11,00,7D  To 32,000 on
21,82,40  From 16514
ED,BO     LD1R
C9        RET
```

To reverse the transfer exchange the addresses so

```
11 82 40
21 00 7D
```

John Nilson,
Redhill,
Surrey.

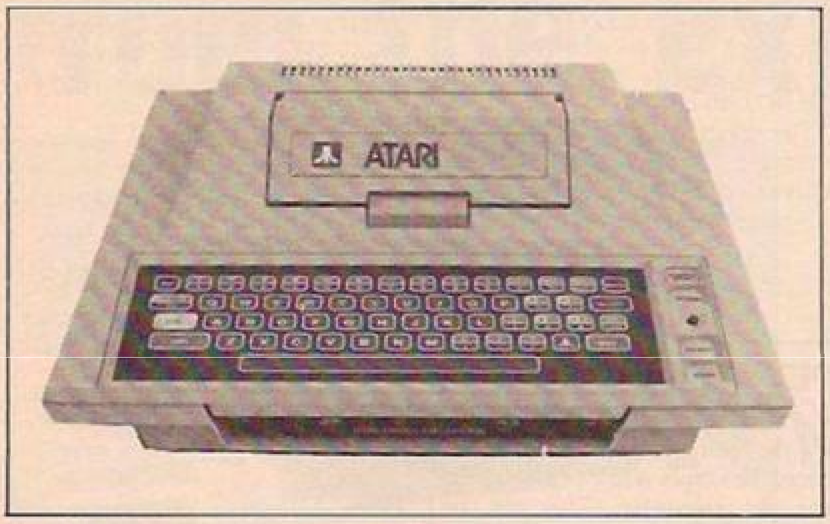
ZX-81 VERIFY

I do not own a Spectrum, but I do verify my programs on my ZX-81. If the Break key is pressed while in the load mode it will either: New, if part of a program is loaded; or Break if the program has loaded or if no program has loaded, giving a report code of 0/0.

Therefore, to verify a program follow this routine:

- Save the program
- Do not press New
- Load the program
- If the loading is completed satisfactorily — 0/0. If the loading failed then either pull out the ear plug then Break, Newline or wait until the screen displays the "I'm looking for a program" picture then Break, Newline. This will result in 0/0 then return the listing — try again.

P Alcock,
Castle Cary,
Somerset.



£50 Binatone will offer 16K, colour, sound and keyboard

BINATONE'S new machine may knock the bottom out of the micro market. At £49.95 for typewriter keyboard, 16K RAM, colour and sound it would be formidable enough, but the news that it is to be sold in the High Street through Woolworths, Argos, Rumbelows, as well as by mail order, should frighten Sinclair and that company's rivals.

Binatone is planning to sell 400,000 machines in the first year alone. This has raised fears of a Japanese takeover of the British market. Binatone will make the machine in Hong Kong using Japanese components. The Binatone will use Tandy TRS-80 software and will be expandable up to 64K.

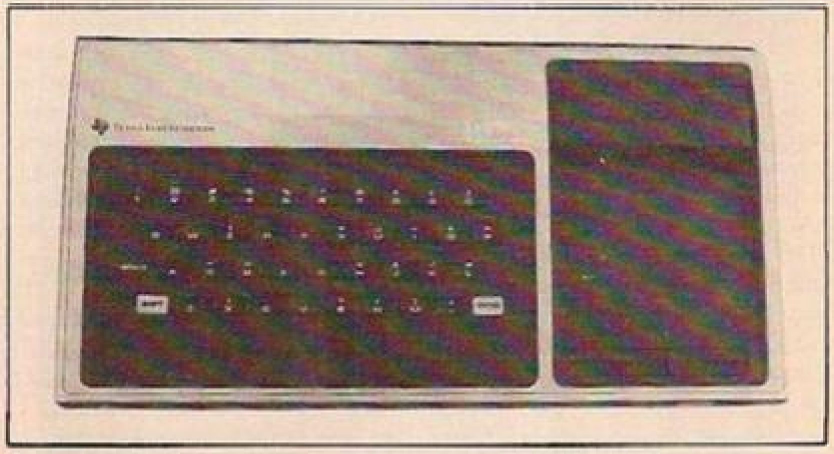
By January, when the Binatone is launched, at least six new machines will probably have beaten it to the market but Binatone is bound to be a strong contender because of its experience in selling consumer electronics products.

Price war is new game from Texas and Atari

TEXAS INSTRUMENTS and Atari have fired the first missiles of a price war that should make Space Invaders look like a vicar's tea party. Atari's 400 and the Texas TI-99/4A will sell for less than £200 — a saving of £100. With the new Dragon weighing in at the same price, there are now five similar computers — including the Vic-20 and 48K Spectrum — battling for the public's favour. All offer colour and sound.

The Spectrum's strength is its memory, while the Atari and Texas rely on wide ranges of plug-in software cartridges — although the Dragon's ability to use certain Tandy Color Computer cartridges may diminish this advantage.

Ever since the *Your Computer* show where Vic-20s were on sale for £135, rumours have been rife that Commodore will drop its prices before launching new models this autumn.



Fry's software library

LEASING BUSINESS software packages for minis and mainframe computers is not uncommon. Alec Fry intends to emulate the practice, in a small way, with a ZX-81 and Spectrum software library. He means to offer a range of 30 programs for hire at £1 each per three-week period. The range will include games, utility and toolkit programs, all commercially produced and on sale elsewhere.

Several software companies are a little unhappy about the scheme. Apart from the scope it offers for copying programs, the scheme raises the delicate question of copyright. Fry aims to operate a payment system similar to that used by public libraries. The Public Lending Right meant that authors gained a copyright fee on books loaned out. At the rate of a few pence per hire this would be a small sop to any disgruntled software writer.

It is very difficult to ensure program security. Most commercial programs start by disabling break and interrupt keys. But with a degree of expertise it is usually possible to circumvent these and other measures. An American firm is even selling a program called Pick A Lock, which is designed to assist breaking and entry — into software, of course.

Midlands show

SINCLAIR users in the Midlands will be able to enjoy an exhibition at the Bingley Hall, Birmingham on Saturday, September 11. The new Spectrum will be on show, so if you are still waiting, at least you can see one.

Spectrum is late for school

FIRST THE good news — twice as many Spectrums are now made as are needed to fulfil incoming orders. Now the bad news — the Sinclair claims that the backlog would be cleared and new orders satisfied within four weeks have proved unfounded. Many who ordered the larger Spectrums have waited eight weeks or more. In addition to the problems with the printed-circuit board, Sinclair's power supply packs have also caused problems on the Spectrum.

Sinclair Research has had to wait almost as long for the Government to fund schools purchasing the company's computers, as customers have for the delivery of Spectrums. Now the Industry Department have added the Spectrum to its approved list. Previously the Government would only pay half the cost if a secondary school bought a Research Machines 380-Z or a BBC Micro.

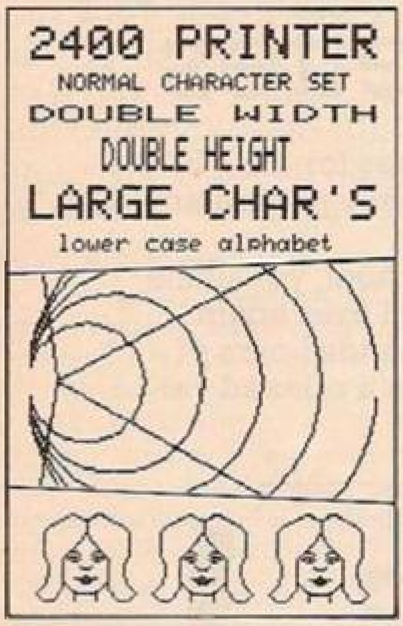
Once your Spectrum arrives there will be no shortage of software for it. Many programs — old favourites and new games — have just been launched. Ex-Sinclair engineer Richard Altwasser, interviewed in last month's *Your Computer*, has produced the Cambridge Colour Collection. 20 programs from Lunar Landing to Home Accounts are supplied on a cassette with a free book for £2.95. Available from Richard Altwasser, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP.

Campbell Systems has produced a disassembler for £5.95 from 15 Rous Road, Buckhurst Hill, Essex IG9 6BL. Newsoft will allow you to add a few extra chips to your Spectrum with Roulette for £4.95 from 12 Whitebroom Road, Hemel Hempstead, Hertfordshire. Jega Software can offer Alien Command from 27 Hallcroft Avenue, Countesthorpe, Leicester LE8 3SL. Quicksilva charges £5.95 for QS Space Intruders, available from 92 Northam Road, Southampton SO2 0PB.

Casio has now introduced a printer for pocket computers and its programmable calculators. The FP-10 mini printer is expected to sell for around £50 and is compatible with the FX-702P hand-held computer, the FX-601P and FX-602P calculators. Printout is at a rate of two lines a second, 20 characters a line. Sales enquiries to Casio Electronics Ltd, 1000 North Circular Road, London NW2 7JD. Telephone 01-450 9131.



Green light for the cut-price Amber printer



AT LAST, a reasonably-priced printer has appeared for a wide range of personal computers. Amber has produced a dot-matrix printer for £69.95 plus VAT, suitable for the Vic, BBC, Atom and others. The company aims to be able to interface with as many different micros as possible including the ZX-81 and Spectrum, although some will need a separate interface adaptor.

Looking rather like a calculator printer's output, the printout gives 24 characters a line on plain paper. This should prove more economical than Sinclair's thermal paper, while providing better quality print.

The Amber 2400 is supplied by Amber Controls, Central Way, Walworth Industrial Estate, Andover, Hampshire. Telephone 65951.



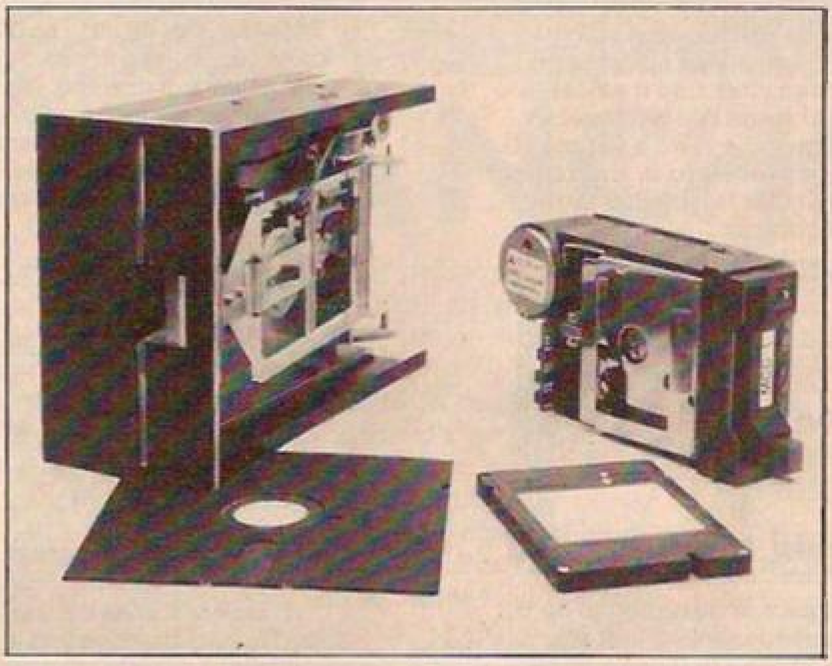
Maestro's Microdrive is beaten to the mark by Balkan BATS

SINCLAIR'S HOPES that his Microdrive would be the first rapid-access low-cost mass-storage device on the market have been smashed by the Hungarian-built BATS MCD-1.

The hardware for the Sinclair drive is now complete and a planned launch, later this year, just awaits some finishing touches to the operating system. Details of its mechanism remain secret.

In the meantime MCD-1, a micro cassette disc drive supplying 150K of memory, is already available for the Vic-20, Video Genie, TRS-80 and the ZX-81. Although the drive is cheaper than conventional disc drives, the cost of a complete system is far higher than cassette systems.

However, there is no doubt many users will consider the gain in saving and loading speed, as well as memory capacity, a worthwhile return for the extra outlay. Having used a disc it is difficult to muster the patience needed for cassette systems.



Many software suppliers believe that small discs will eventually replace cassettes as a medium for games.

Macronics has beaten Sinclair Research to the post by offering drive and interface for the ZX-81 at £160. The package includes disc drive, interface card with disc-interface programs, an expansion motherboard to permit extra RAM and printer to be attached, connecting leads, and 2K RAM.

The drive, which is notably compact, runs a 3in. floppy disc encased in an audio-type cassette. BATS-NCI, the distributor, claims two advantages for it over other floppy disc drives. It maintains that the disc is better protected by a rigid cassette and the drive motor is said to be more robust.

BATS-NCI, which supplies a drive on its own for £60, can be contacted at 375b Regents Park Road, London N3 1DG. Telephone 01-349 4511. Macronics can be found at 26 Spiers Close, Knowle, Solihull, West Midlands B93 9ES. Telephone Knowle 3693.

Audiogenic Vic cartridge

ANOTHER VIC-20 utility cartridge has apeared on the market — Audiogenic's programmer's aid, Buti, offers the usual range of facilities — such as Renumber and Trace — plus two new features.

Buti supplies an extra 3K of memory, hex-to-decimal conversion and a command which reformats the Vic to 3K or 8K memory configurations.

Retailing at £39.99, it is available from Audiogenic Ltd, PO Box 88, Reading, Berkshire or from Vic dealers.

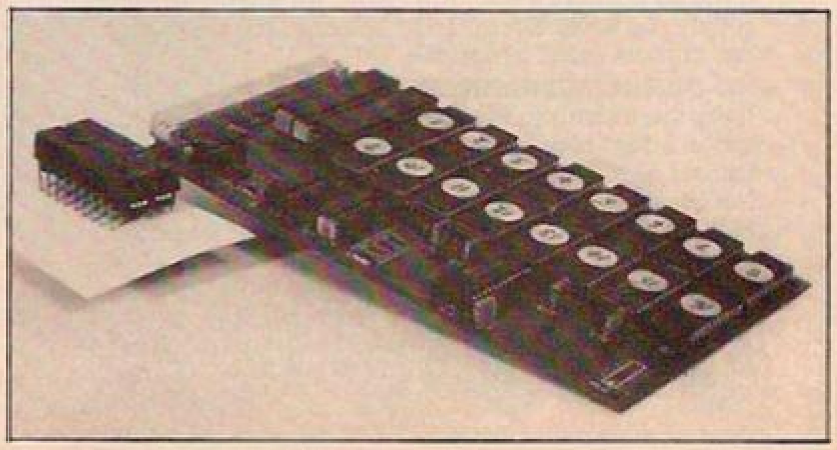
ASK for more education

SOME USERS have criticised much of the available educational software for being insufficiently aware of teaching techniques and requirements. A teacher writing recently complained that there were too many drill-type programs. In response to this kind of criticism, several software companies have developed programs designed by people with classroom experience.

ASK Ltd has assembled an impressive battery of educational experts to design their programs, which are then implemented by programmers. It has released four games with an educational purpose for the Vic-20. Intended for children at primary school level, three of them are engrossing enough for those in other age brackets.

These cassettes cost £8.95 each and are available direct from ASK, London House, 42 Upper Richmond Road West, London SW14 8DD, or selected dealers. Telephone 01-876 0102.

Eric, stage left, is examining the Tangerine Users' Group latest add-on for the Microtan 65. The new EPROM storage card will accept 32/64K of 2716 or 2732 EPROMs allowing fast mass data of transfer of stored programs into user RAM. Programs can be accessed manually or automatically under software control. Up to four cards can be banked on the system rack. Available for £38 plus VAT from TUG, 16 Iddesleigh Road, Charminster, Bournemouth, Dorset BH3 7JR. Telephone 0202 294393.



£8.95 plus 55p p+p

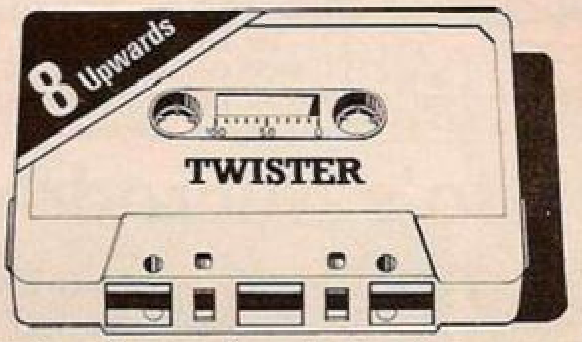
Very Important *Educational* Cassettes

A.S.K. announce the first four programs in a series of educational cassettes for the VIC 20. These programs have been written by a team of teachers and professionally programmed specifically for use in the home.

They are of proven educational value, complementing work done at school, yet all the programs are designed to be fun to use — not just once, but over and over again. We believe that these programs will give you and your family and friends hours of worthwhile enjoyment. They will help your children to learn at home in a relaxed yet stimulating way.



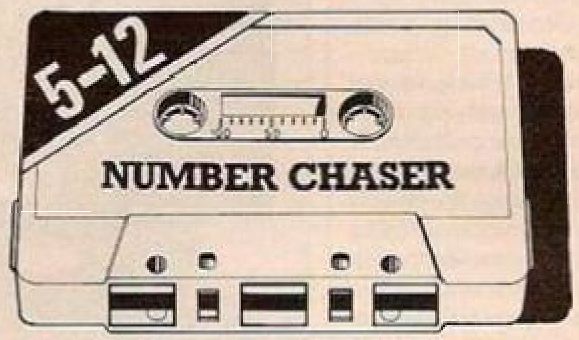
We Want To Count. A program for young children learning to count which involves the numbers 1 to 5. Children often find it easier to recite numbers than to count things correctly. Four different games give the child a variety of objects to count, and are presented in an exciting and stimulating way. Suitable for children aged 3 and upwards.



Twister. A geometric puzzle that will tie you in knots, testing and improving your thinking skills and powers of concentration. The purpose is to rearrange coloured squares so that no row or column contains a repeated colour. Set your own puzzle and test the whole family. Suitable for children aged 8 and upwards.



Facemaker. This program is designed to help improve spelling, expand vocabulary and sharpen observational skills. There are thousands of characterful faces you can make with the program. Perhaps someone you know? Suitable for children aged 5 to 12.



Number Chaser. A car race provides an opportunity to practice and improve estimating and multiplication skills. You can choose the level of difficulty you want making it different every time you play. Suitable for children aged 5 to 12.

Each cassette comes in an attractively labelled box together with a colour booklet which gives detailed loading instructions and tells you how to use the program.

N.B. Because these programs make extensive use of computer memory and colour graphics, a 16K RAM PACK (or 8K RAM PACK for Numberchaser only) and colour T.V. are essential for their operation.

If you do not have a 16K RAM PACK, we will be pleased to supply one at the discounted price of £67.50 with your order for one or more A.S.K. programs.

NO QUIBBLE GUARANTEE

If you are dissatisfied with any A.S.K. program, return it to us within 7 days of delivery and we will give you a full refund without question.

Not convinced? Then see our programs at The Vic Centre, 154 Victoria Road, London W3, opp. North Acton tube.

A.S.K.

A.S.K. LIMITED, London House, 42 Upper Richmond Road West, London SW14 8DD

To A.S.K., Freepost, London SW14 8BR (no stamp required)

Please send me:	Quantity	Unit price inc. VAT + 55p p+p	Total
We Want To Count		£9.50	
Twister		£9.50	
Facemaker		£9.50	
Number Chaser		£9.50	
16K RAM PACK		£67.50	
		TOTAL	

I enclose my Cheque/P.O. for £ ______ made payable to A.S.K. LTD

Name ______

Address ______

______

Please allow 28 days for delivery YC8

Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.



MANCHESTER

Boris Allan discovered a CB freak using a UK 101 in a pub, and a monitor made out of a cardboard box — in true Blue Peter style — when he visited Manchester Computer Club.

MANCHESTER COMPUTER CLUB is so energetic that it has become known as MC^2. Twice a month the members meet at the University of Manchester Regional Computer Centre. The first Thursday in the month is a lecture, and the third a workshop.

When I arrived at a workshop session, having warned the secretary Dave Wade beforehand, nobody knew anything about my visit — "We're very informal".

I told one of the members, "I come from *Your Computer*", to much merriment. They all thought that his computer was too stupid even to give simple orders.

Machines were scattered all round. Many looked out of the ordinary, particularly the one whose monitor had sides made out of cardboard boxes. Members own everything from ZX-81s to a home-brewed 6809. Advice was plentiful if slightly unhelpful, "Why don't you buy a decent machine?".

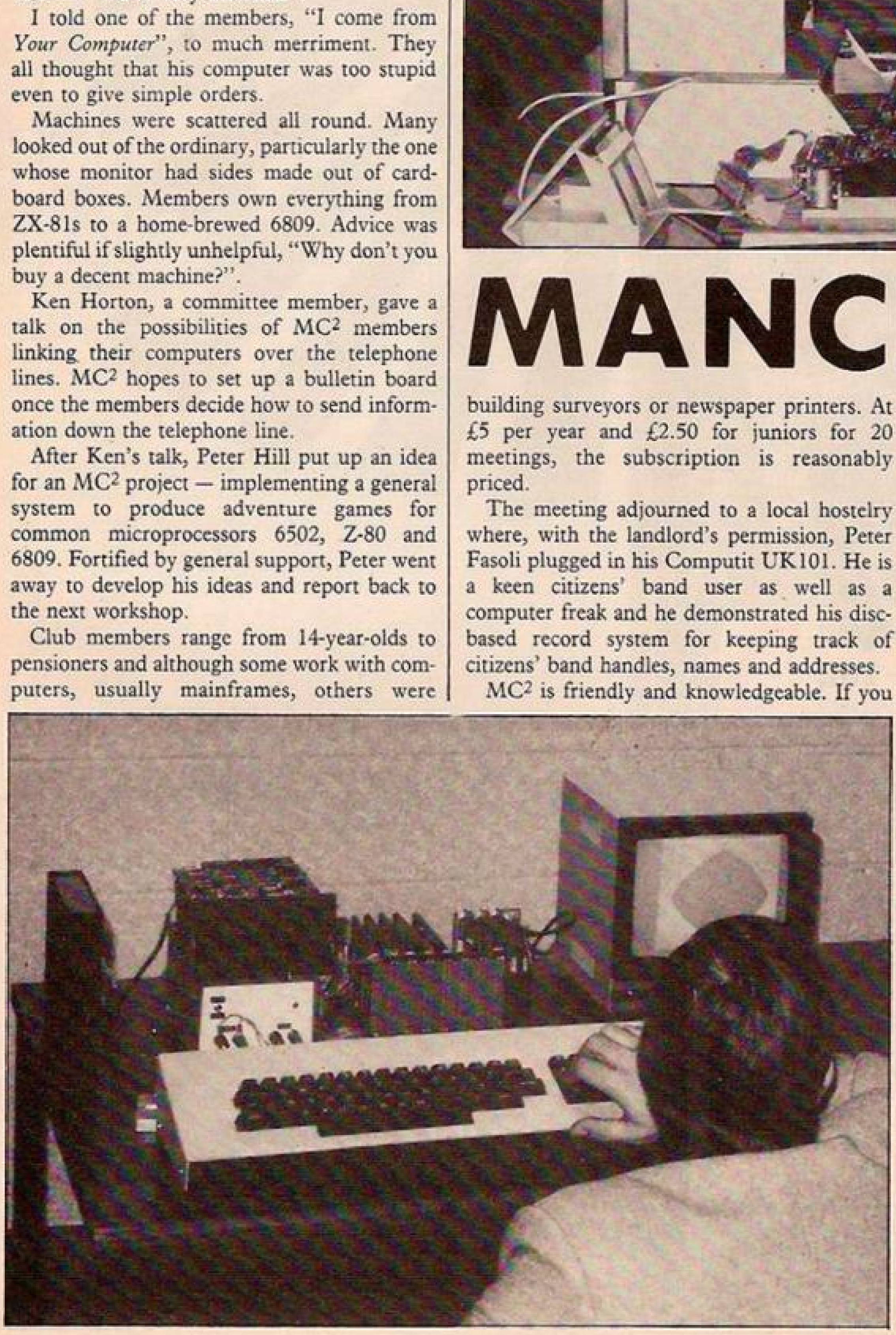
Ken Horton, a committee member, gave a talk on the possibilities of MC^2 members linking their computers over the telephone lines. MC^2 hopes to set up a bulletin board once the members decide how to send information down the telephone line.

After Ken's talk, Peter Hill put up an idea for an MC^2 project — implementing a general system to produce adventure games for common microprocessors 6502, Z-80 and 6809. Fortified by general support, Peter went away to develop his ideas and report back to the next workshop.

Club members range from 14-year-olds to pensioners and although some work with computers, usually mainframes, others were building surveyors or newspaper printers. At £5 per year and £2.50 for juniors for 20 meetings, the subscription is reasonably priced.

The meeting adjourned to a local hostelry where, with the landlord's permission, Peter Fasoli plugged in his Computit UK101. He is a keen citizens' band user as well as a computer freak and he demonstrated his disc-based record system for keeping track of citizens' band handles, names and addresses.

MC^2 is friendly and knowledgeable. If you live in the Manchester area, and want to find out more, contact Dave Wade, 28 Hazel Road, Altrincham, Cheshire. Telephone: 061 941 2486.



Local news

Blackburn

BLACKBURN Computer Club meets on the first Monday of every month. Dave Walsh the secretary is planning a monthly newsletter. More details from Mark Brummler, the membership secretary, Vulcan Hotel, Nab Lane, Blackburn, Lancashire. You can telephone Dave Walsh on 0254-661518 or Mark Brummler on 0254-52431 for venues.

Harlow

HARLOW Advice Centre hosts the Harlow Microcomputer Club every third Tuesday of the month. Bob Robson of 81 Stile Croft, Harlow, Essex will be pleased to send you information about the club. Telephone Harlow 20730.

Fife

FIFE Computer Club relies on its newsletter more than some of the metropolitan clubs do. Members have to travel long distances to attend meetings. Membership is, however, limited to people between the ages of 12 and 20. More details from Murray Simpson on 0334-72485. ■


RSONAL CO

LONELY Genie I Microcomputer, early eighties, with large peripheral family but currently unattached, would like to meet interesting, attractively packaged software, Genie or Tandy specification, for programming, problem solving, entertainment and long-lasting friendship. Reply in confidence. Box No RS232.

ANSWERING MACHINES



ingenious ...but lonely!

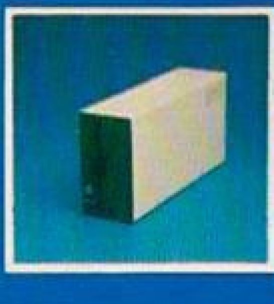
Buying your first Genie I microcomputer is just the start of a long and enthralling adventure, for it won't be long before you will want to expand your system with some of the wide range of peripherals which make up the complete Genie System.



Firstly there is the **Expansion Box,** which immediately expands your Genie's capacity to 32K RAM, and up to 48K RAM if required. It can be connected to 4 disk drives, a printer, RS232 interface or S100 cards.

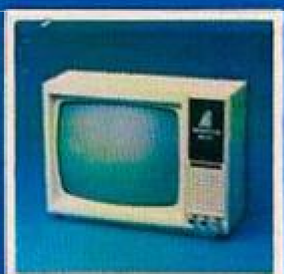
Then there is the **Printer,** a compact unit with 80 column, 5 x 7 matrix print-out, which connects to your Genie through the Expander, or via the Parallel Printer Interface.





The **Disk Drive** gives you greater storage capacity and full random access file handling, with the option of double-density through a special adapter. New Dual Disk Drive now available!

Finally, there is Genie's very own **12" Monitor,** a must if you want to let the rest of the family watch their T.V. in peace! Available in B & W or green tube.



The supreme advantage of the Genie I system is its compatibility with the TRS 80, which means that literally 1000's of pre-recorded programs are already available, just waiting to be plugged into your Genie!

The recent improvements in the Genie system, including Extended Basic, sound unit and machine language monitor, make it the ideal system for the committed hobbyist, and an excellent and easy-to-use educational tool.

SPECIAL TECHNICAL GENIE HOT – LINE ON 0629 4995

for all your technical advice and service back-up on any aspect of the Genie system direct from the experts!

Please send me FREE, 16 page colour brochure on the Genie Computer System. I enclose 25p postage.

Name ____________________

Address ____________________

____

Telephone ____________________ YC-82

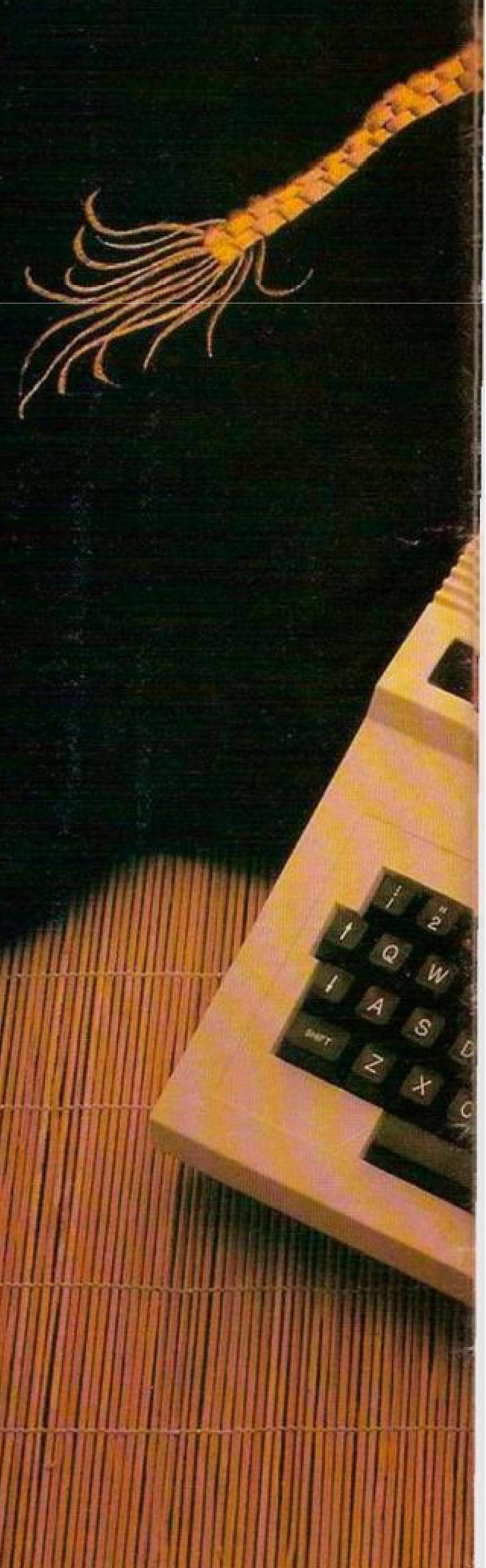
LOWE electronics

Chesterfield Road,
Matlock,
Derbyshire DE4 5LE.
Telephone: 0629 4995.
Telex: 377482 Lowlec G.

If the sales hype for the new Dragon 32 is to be believed, it really is magic. Tim Hartnell looks at this new British rival to the Spectrum and rates the real keyboard and 32K RAM as good value for £200, despite flaws in the manual, and in the colour and maths ROMs.

REVIEW





A DRAGON FOR YOUR DUNGEON

METTOY'S NEW plaything may become a strong contender for the title of "most popular micro under £200". British-assembled and designed, around a Tandy Color Computer ROM, the Dragon will sell for slightly less than £200.

If the demand created by advertising can be satisified Mettoy's High Street distribution should ensure that tens of thousands are sold before Christmas.

Full-size keyboard

For your money you get a fairly large but light-weight unit, with full-size typewriter keyboard. There are sockets for standard joysticks, Centronics parallel printer, ordinary television or a monitor, and a slot for plug-in cartridges. The computer loads and saves on ordinary cassette machines, using a surprisingly reliable interface.

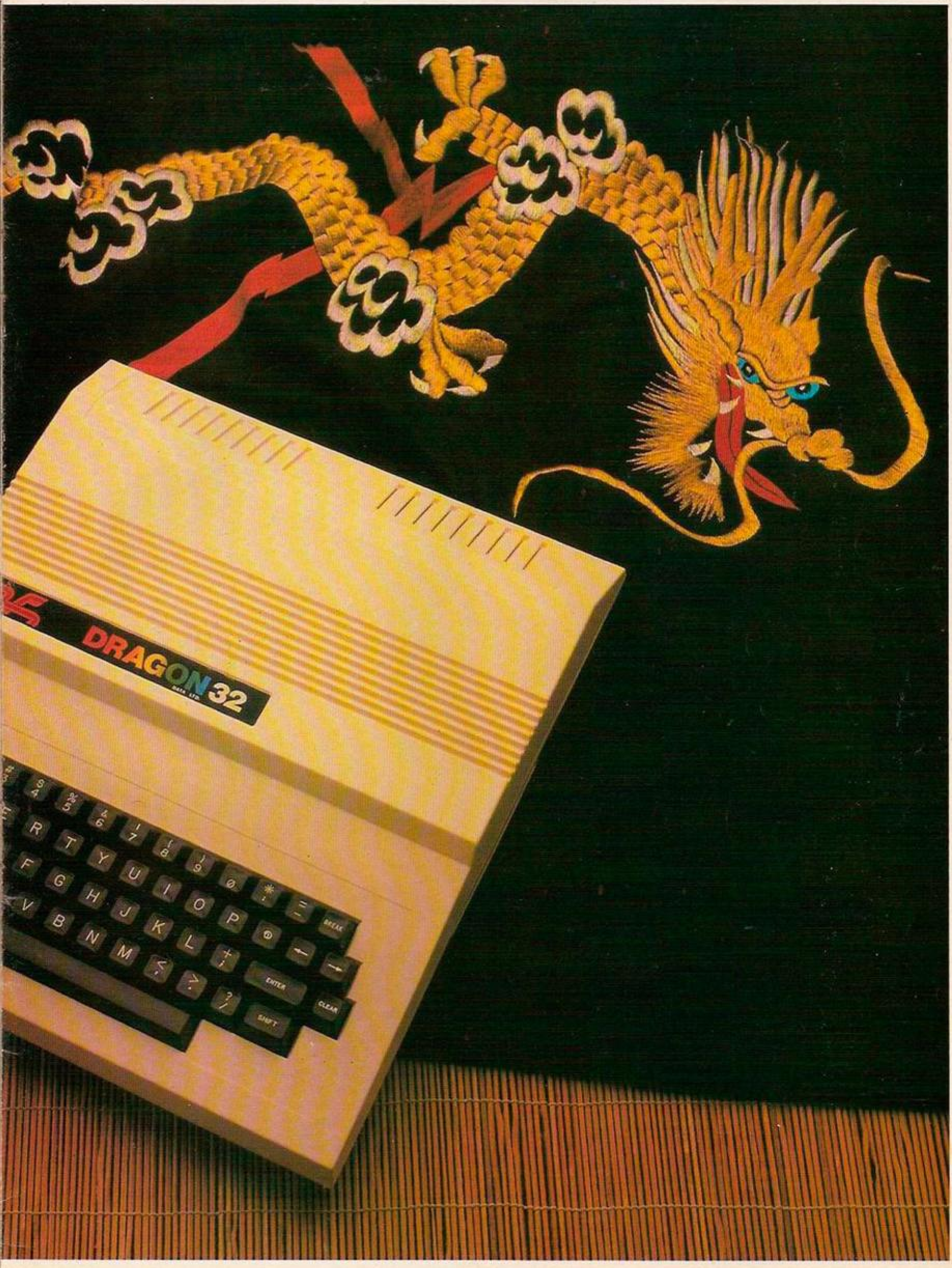
The Dragon, which has 32K of memory, with 26K available to the user, was developed in Cambridge. The memory can be expanded to 64K. Most of the memory is available for the user; it is not consumed supporting the machine — although each graphic page in the high-resolution modes takes around 1.5K. By contrast, the Vic-20 makes available less than 6K and the BBC model A operating in mode 4 less than 4K.

The Dragon offers an extensive colour Basic, with nine-colour display and high-resolution graphics, 256 by 192 in the highest mode, the same as the ZX Spectrum. There is a trade-off between the degree of resolution and the number of colours available. That is, the higher the resolution, the fewer the colours you can put on the screen at once. The Dragon can be used with a standard TV set or monitor and offers 16 rows of 32 characters display, fewer lines, but the same number of characters across, as the ZX-81 and Spectrum.

Levels of resolution

A range of preset colour chunky graphics is available. There are five levels of resolution, point-by-point drawing, with point-by-point colour, a feature not available on the Spectrum, with commands to obtain lines,

(continued on page 22)


DRAGON 32

(continued from page 20)

arcs and circles. There is also a fast-operating paint-in command to produce solid areas of colour.

Sound output is through the TV speaker. The manual claims five octaves, 225 tones, 155 tempos and 31 volume levels. The sound is clear, but the single voice limits its potential applications.

You can turn the cassette player off and on from the computer, which opens up the possibility of running a program which turns the cassette off and on at particular points. This has some good educational possibilities, such as having French words spoken from the tape as they are displayed on the screen.

Dragon did not announce the computer until the production lines were running, in the hope of avoiding supply problems. Dragon Data is offering the machine to almost anyone who will stock it, sidestepping the extraordinary control over retail outlets which other companies have exercised.

Will Dragon ensure that stockists know enough about the machine to help potential buyers, and those with after-sales problems?

The company has already produced software on cartridge, including educational and games packages. Cartridge games include Ghost Attack, a Packman variant and arcade games such as Berserk, Cosmic Invaders and Meteoroids.

All cartridges cost £19.95, except for Ghost Attack which is £24.95. This software is expensive for a £200 computer. Eight programs could cost you as much as the computer.

Learning element

Games packs on cassette cost £8 each. The Dragon Special Selections are written in Basic whereas the cartridges are in machine code and are designed to be Listed on the screen, so you can follow through a program, to work out how it does what it does — adding an element of learning to straightforward games playing. You can learn how to construct a simple database such as a telephone list, operate a do-it-yourself calculator and try out a metric converter.

Unlike many programs available commercially, the Special Selections are totally transparent, so that you can follow every stage of the program and increase your knowledge of programming as you examine the listing.

Dragon also plans to introduce personal finance programs, and a Compuvoice cassette, that will allow you to add phonetic sounds, so you can make your computer speak with a regional accent if you have the patience to program it to do so. Hardware expansion plans include a disc operating system, a serial RS-232 port, and a major operating system.

The computer promises to be one of the first computers which has been properly marketed in the U.K., supported by software, standard hardware and peripherals and adequate distribution and supply. In many ways, it appears to be what the Vic-20 could have been, if Commodore has not been plagued with production problems, limited user memory and fairly coarse graphics.

Richard Wadman's manual takes the first-time user step by step through Dragon Basic and programming. Unfortunately Wadman launches straight into difficult and boring mathematics.

The moving-graphics section is an improvement on the Spectrum manual. A joystick-controlled, space shoot-out game is listed and explained. However, the manual becomes very difficult to follow when it tries to explain how to use the colour. The trouble stems, in part, from Dragon's Basic. The colour is not particularly easy to use above mode 0, perhaps this is part of the price for buying an old off-the-shelf, ROM.

Dragon may have to rewrite the colour section of the manual to make it clearer.

Some of the graphics routines I tried crashed halfway through. Somehow, I had typed in something which meant the machine refused to enter any mode above mode 2. Dragon Data claimed the routines worked on five other machines. I tried the routines again a few days later, and discovered they ran perfectly.

As I was using a machine with an EPROM, there may have been some subtle error which hopefully will not be present in off-the-shelf Dragons.



CONCLUSIONS

- On a scale of 10, I would give it a seven or eight, with points being earnt by the extensive Basic, the real keyboard, standard sockets, and wide availability.
- The Color and Edit commands are a drawback because they are complex and far more fussy than some other machines on the market.
- The manual has too formal an approach to some aspects of computing, and a bewildering method of explaining the colour.
- The maths in the ROM is a little odd, not even holding some powers of two exactly, like 2^5.
- Software support from the machine's launch suggests an intelligent approach to marketing, in which satisfying market demand is considered more important than involving the whole of the U.K. in a kind of product debugging exercise.
- The Dragon is more expensive than the Spectrum or Atom but the cost is justified by the keyboard and peripherals.
- The computer offers more memory for the price than any machine on the market other than the ZX Spectrum. The colours, although difficult to use, are good and clear, except for the red which was far from satisfactory.
- The cartridge software is as expensive as the Vic-20's.
- The keyboard, although it feels plasticky, is an enormous improvement over touch-sensitive ones, and at least has a space bar. ■

You can't get a Home Computer from Texas Instruments under 16 K RAM.



Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

Just compare the versatility of the TI Home Computer with its price–you'll find it real value for money that will prove to be a good long term investment.

The TI-99/4A is a sophisticated computer designed not only for the beginner with its ease of operation, but also for the professional with its vast computing power through a 16 bit microprocessor. And it simply plugs into an ordinary household TV set.



With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages–UCSD-PASCAL, TI-LOGO and ASSEMBLER–and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is around £200. When you want to solve problems there are over 600 software programs available worldwide–including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.

We'll help you do better.

TEXAS INSTRUMENTS
LIMITED

® Registered Trade Mark
Texas Instruments

Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

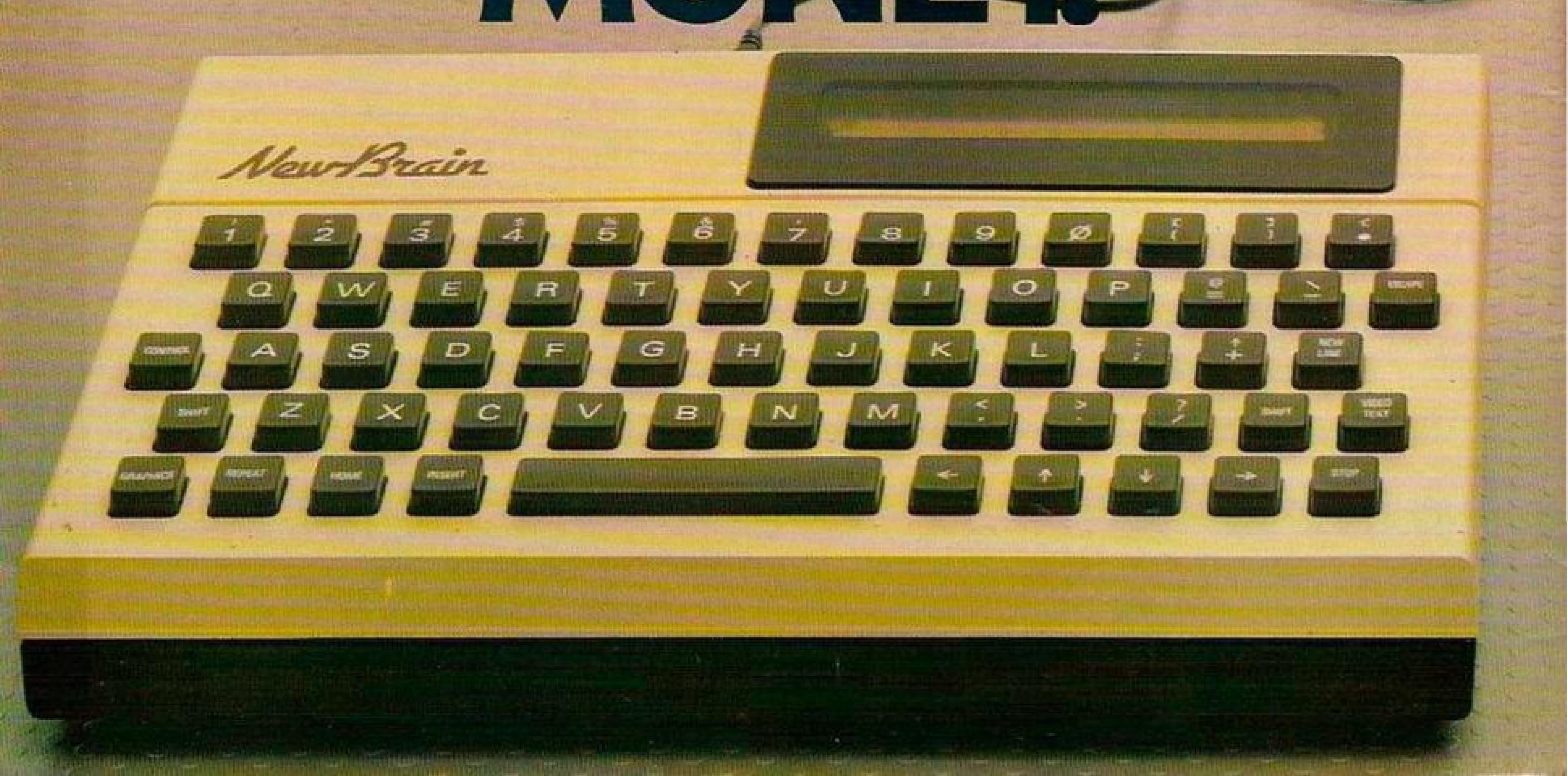
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

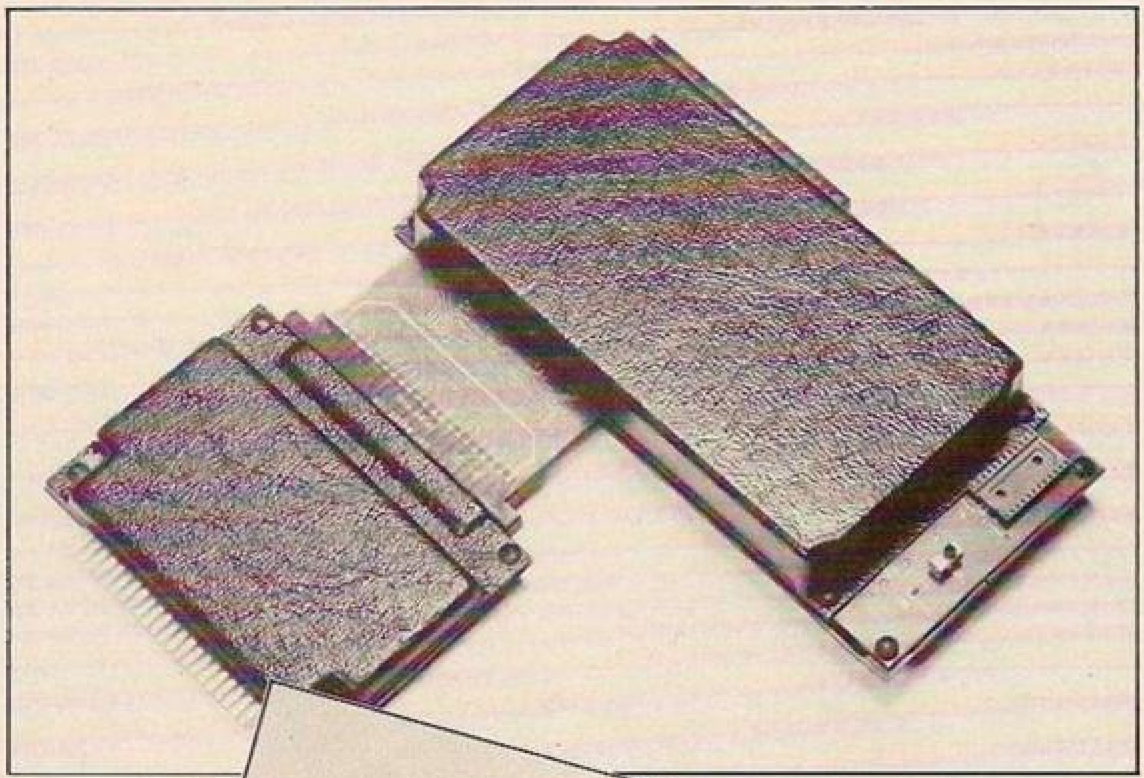
Far from it.

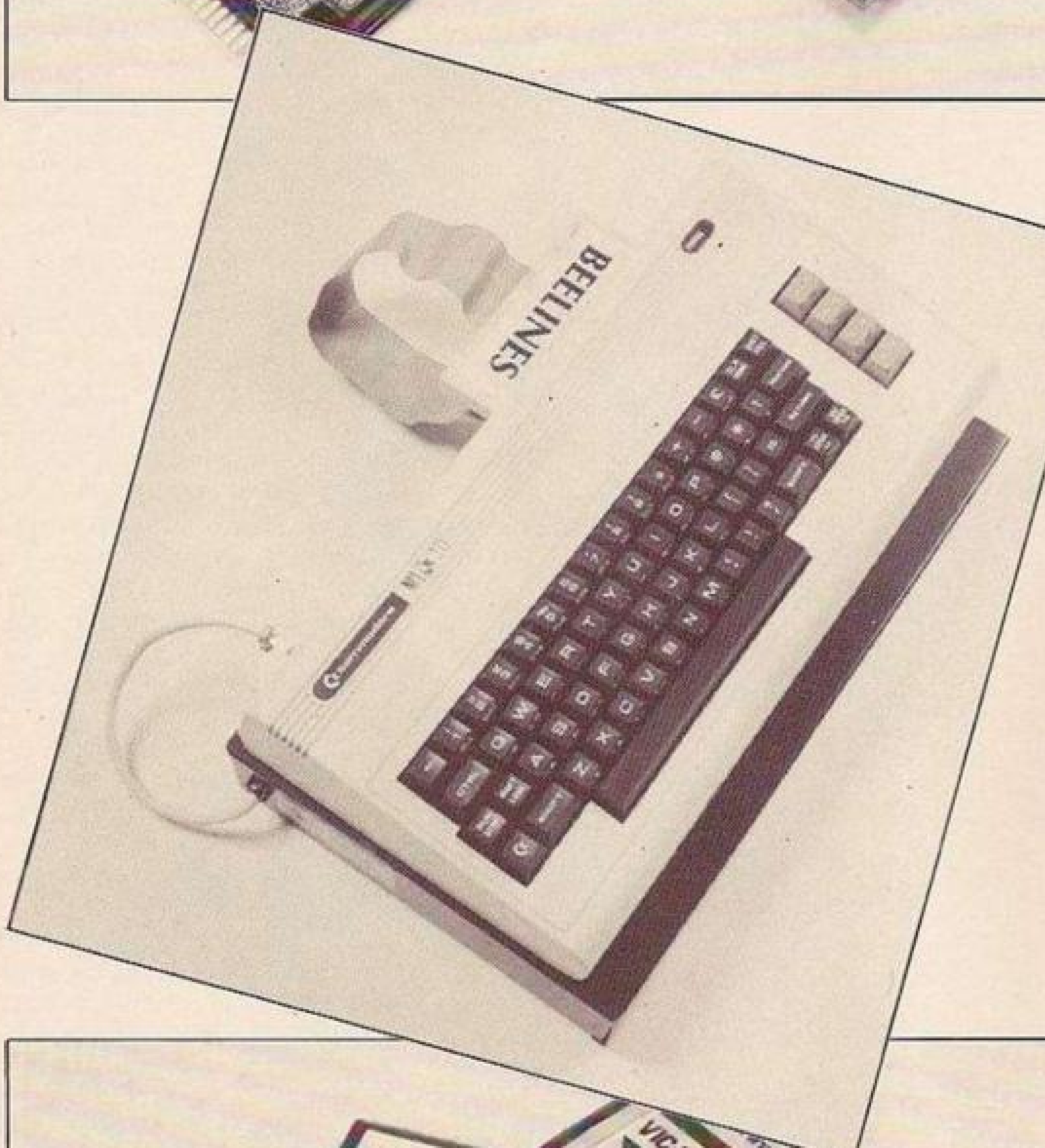
It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

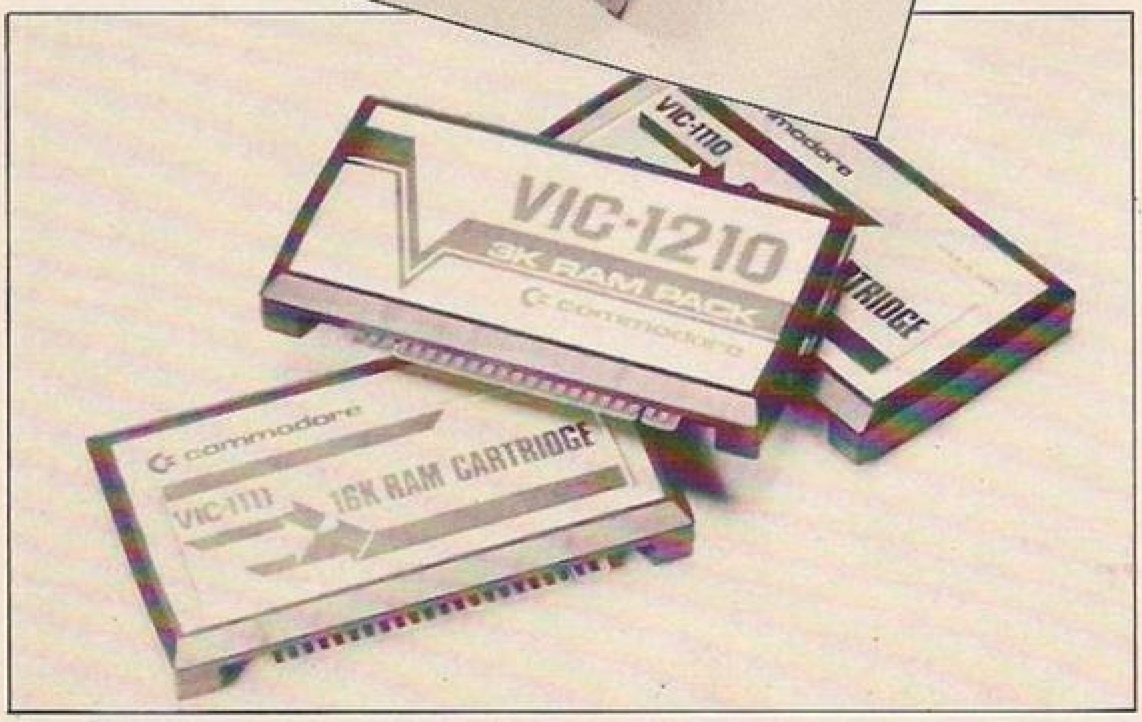
And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

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SURVEY

VIC EX

Expand that tiny memory and you could take advantage of all the Vic's good features. Boris Allan examines some of the leading manufacturers' memory extension boards and cartridges for the Vic-20.

THE FIRST question we asked when reviewing the Vic-20 memory-expansion units was, "How good is the idea?", and we judged that probably the best ideas were to be found in the Stack products — 3K memory and Storeboard. By their very nature, when cartridges are plugged into a socket, that is the end — nothing can be added. Both the Stack 3K RAM unit and the Storeboard have sockets at the rear to enable the user to add further accessories — in a similar manner to many of the ZX-81 add-ons.

The quality of the conception behind the cartridges from Commodore and that from Arfon was not brilliant, but adequate. The Arfon expansion unit was large and not cleverly conceived. The Beelines Beebox, because of its design, tended to obscure the television if the television and the Beebox were on the same level. Generally, a set of staid products which are far from the forefront of design.

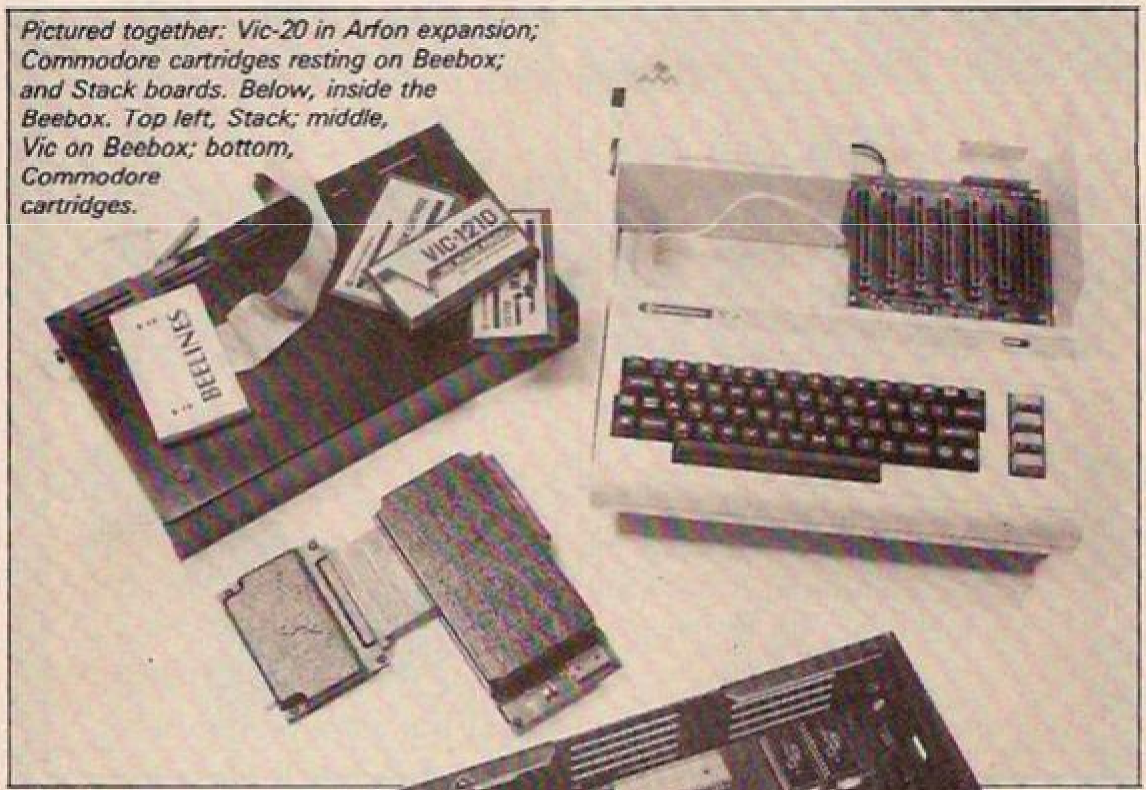
Ideas in practice

One can have a clever idea, and carry it out badly; equally one can have an ordinary idea, and execute it extremely well. The Stack products were clever ideas which suffered in practice. For example, there was not sufficient rigidity in the connection to the cartridge slot. The Stack Storeboard had a further complication, in that, though designed to take an extra 24K which is plugged into the board by the user, we were unable to open the case. Though it must be possible to open the Stack unit, our failure bodes ill for the ordinary user.

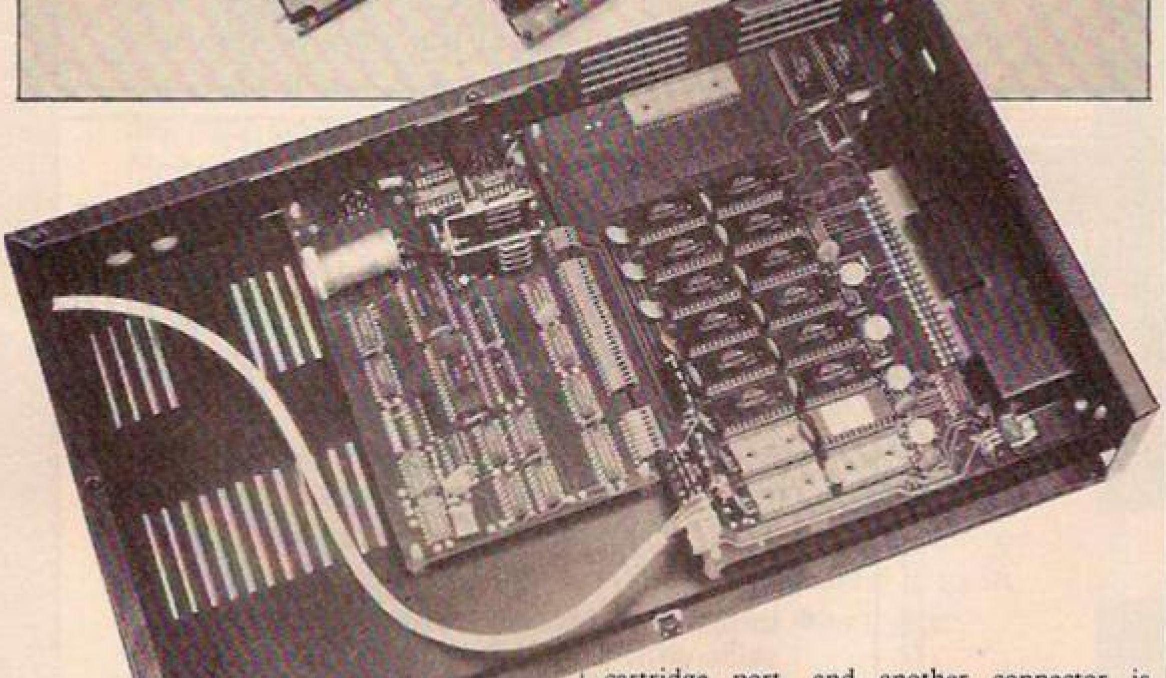
The Stack units seemed to be well constructed, and the printed-circuit boards seemed to be well prepared, but — on a personal note — we did not like the black leatherette covering of the Stack units.

The Arfon expansion unit needed little examination to reveal that it was solidly constructed — the case seemed to weigh a ton. It was here troubles started: we had been supplied with a case into which the Vic-20 is eased and the rear cartridge port has to engage with a well-produced printed-circuit board. So far, so good — even if a little tight — and then we realised that the case needed a lid on which the television should sit; an "optional" extra it would appear. Without it we were unsure where to put the TV. A well-made, if incomplete, piece of equipment. The Arfon cartridge

PANSION UNITS



Pictured together: Vic-20 in Arfon expansion; Commodore cartridges resting on Beebox; and Stack boards. Below, inside the Beebox. Top left, Stack; middle, Vic on Beebox; bottom, Commodore cartridges.



— the expansion unit has seven slots for such cartridges — seemed to be equally well constructed, as did the Commodore cartridges.

The Beelines Beebox is supposed to do two jobs: it increases the capacity of the Vic-20 and also it provides a 40-column facility with Prestel graphics. The Beebox is a black box slightly wider and deeper than the Vic-20, and about 2in. to 2.5in. high. The Vic-20 is supposed to sit on top of the box. Unfortunately, there is no provision for raising the TV, so the Vic and box obscure the television picture.

A connector is plugged into the Vic cartridge port, and another connector is plugged into the user port: the television connection is either plugged into the box for Prestel graphics or into the Vic-20, with adjustment of memory switches for the expanded Vic with Vic graphics.

Cartridge connections

The cartridge connector on the Beebox seemed a poor piece of work: there were spaces in the top of the cartridge connector covered by a piece of wide plastic tape, which one could easily break accidently. The metal teeth did not extend to the edge of the connector.

All the Commodore cartridges worked perfectly well, as did the Arfon cartridge and the Stack 3K memory but, as noted, we could not open the Stack Storeboard.

Our problems with the Arfon expansion unit were to do with inconvenience, which was unfortunate for a device which is to add to convenience of use. To fit the Vic-20 into the unit was an awkward business as was arranging the cassette lead. To change the cartridge one either had to remove the television and lid, or not use the lid. It is not possible to address the slots by name, which is a pity, especially as it seems part of the design philosophy.

The Beebox worked as an expanded Vic-20, but did not work as a Prestel graphics machine. That is, a machine which uses Prestel graphics, but is not, as yet, connected to the Prestel system. Plugging the TV into the We could obtain nothing but snow on our screen when we tried the other variant.

Prestel graphics

The Prestel system worked fine on Beeline's monitor, but not on the television, even though standard Vic-20 graphics on the Beebox worked perfectly. Programming the new machine was not like programming the Vic-20, because none of the standard Vic characters were available, everything was in lower case, and shortened commands such as Pr had to be typed pR. When in Prestel mode the sound generator was unavailable, and so the Vic-20 was silent.

While trying to make the Beebox work, we went through the documentation carefully, and like much documentation it left a good deal to the imagination. The *Beebox-40 User Manual* has been produced — it appears — by a word processor, and so instead of proper diagrams there are pretend diagrams. A pretend diagram is one which is not drawn, but uses dashes, colons, and stars, to indicate lines. The use of such diagrams means it is more difficult for the reader to understand. We did not find the manual very useful, and would have liked at least one circuit diagram.

The Arfon documentation was better, without being fantastic — at least it had a diagram. The Stack documentation was interesting. It had a demonstration program, and more spelling mistakes than any other but it was still not enough — no circuit diagram, for example. The cartridges had no explanations, except for the one from Arfon — but none was really needed.

Though most people do not want circuit diagrams with the increasing sophistication of the ordinary user, more people soon will.

The final question must be, "Does the product do what is promised? What *is* promised?" For all cartridges we can say "yes". The Stack low-cost 3K RAM depends on what you consider to be low cost, and we felt that the advertising of the Storeboard

(continued on next page)

(continued from previous page)
might be misleading. In the advertisement it is claimed that you can power up the Vic-20 to a massive 32K, for "only £49", but beneath the price you read in smaller type "(plus VAT) for 3K". So you find you have to add 24K RAM yourself, and pay for it. I do not like such a hard sell of decent equipment.

The Arfon expansion unit is commonly pictured with a TV sitting atop, with the optional lid in use. This is not fair, because it is not the standard unit, and can easily confuse.

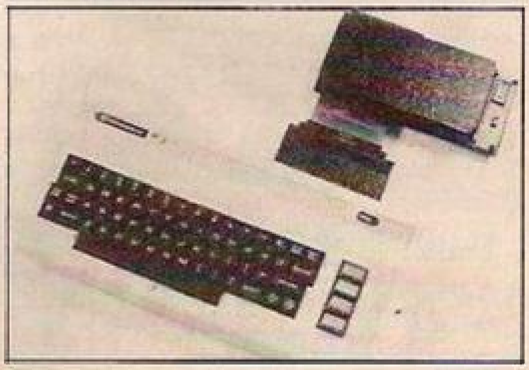
Beelines claims that the Beebox makes you "the owner of a pint that thinks it's a quart", but later the company has a disclaimer which says that "no claim is made concerning the reliability of this product. Beelines . . . cannot assume liability or responsibility for any loss or damage arising from the use of this product . . ." The Sale of Goods Act might have something to say about such disclaimers, so do not be fooled — if a product is not reliable, it is not fit for the purpose for which it was sold, and you still have your rights in common law.

CONCLUSIONS

- Remember how much each of these goodies costs, and compare its cost to the cost of a Vic-20 when you are making your decision to buy.
- Buy any of the cartridges, but you will not be able to expand without the cartridge possibly becoming redundant. The Stack products though insubstantial, are not too highly priced — note that I did not say "cheap".
- The Arfon Expansion Unit is substantial, well-made, but expensive, and it is not as convenient as it might be — especially without the optional lid.
- The Beelines' 40 characters are available only in Prestel mode. ■

Company	Units reviewed	Cost	Address
Arfon Electronics	Vic-20 Expansion Unit 3K RAM Cartridge	£85 plus VAT £26.04 plus VAT	Cibyn Industrial Estate, Caernarfon, Gwynedd. Tel: 0286 5005
Beelines	Beebox-40	£253 including VAT	Beelines Bolton Ltd, 124 Newport Street, Bolton BL3 6AB Tel: 0204 385299
Commodore	3K RAM Cartridge 8K RAM Cartridge 16K RAM Cartridge	£29.95 £44.95 £74.95	Commodore, Baker Street, High Wycombe, Bucks. Tel: Slough 79292
Stack Computing	Low Cost 3K Memory Storeboard	£25.99 £49.	Stack Computing, 290-298 Derby Raod, Bootle, Merseyside Tel: 051 933 5511





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MELBOURNE HOUSE • ZX81 • SPECTRUM

Last month Tim Hartnell majored on the Spectrum's graphic and colour capabilities. Now Tim Langdell tackles its sound facilities and develops further the colour theme.

LIKE THE ZX-81, the Spectrum was built down to a price and not up to a specification. This meant that Sinclair Research tried to assess how much you and I would be willing to pay for a micro with colour, sound and high-resolution graphics, and designed the Spectrum accordingly. It quickly becomes apparent when you explore your Spectrum's facilities that, to give you reasonable colour and graphics for the money, Sinclair Research seems to have skimped on the sound capabilities. In fact, its sound is poor.

To produce sounds on the Spectrum you use an aptly-named command called Beep. This command is followed by two numbers, the first of which is the duration of the note in seconds, and the second the pitch of the note in semitones above middle-C. Thus,

BEEP 1, 0

sounds middle-C for a second,

BEEP 1, 1

sounds C-sharp for a second, and so on. The note can be from about 0.00125 seconds — any shorter and it is not audible — to around 10 seconds.

To be more accurate, notes from around 60 semitones below middle-C, which is the lowest pitch, to about 50 above can be up to 10 seconds long. From there upwards, the note has to be shorter, until at the maximum pitch of 69 semitones above middle-C the maximum duration is about four seconds.

The problem is, though, that the sound is extremely quiet. Even in a silent room it can be difficult to hear anything much higher or lower than the middle-C. The highest notes are virtually inaudible and perhaps this had led to the criticism that the Spectrum can produce pitches so high that they are only useful for annoying bats.

In fact the top pitch is about 13,300 Hz, or five and three-quarter octaves above middle-C. This is almost two octaves above the range of a piano but still, in theory, well within most people's hearing range. Certainly my bat is not at all bothered by the highest notes.

The very low volume must be considered a design fault and I hope Sinclair Research is already preparing a modification for future Spectrums.

The only way to make the sound louder is to take an output via either the microphone or ear socket at the rear of the Spectrum and feed this signal into the microphone socket of your hi-fi amplifier, or into a similar input of whatever amplifier you might have.

The signal from the ear socket is a little stronger than from the microphone socket. I found that the signal is reasonably strong and easily overloaded the input of my cassette player. Connecting it up to my hi-fi's microphone socket worked better because my Yamaha amplifier comes equipped with a volume control on its microphone input. By doing this I could obtain considerably louder sounds which were much richer in quality than the sound coming from the Spectrum's own speaker.

The quality of sound varies a great deal, though, across the pitch range. The lowest notes sound like a series of clicks rather than music, and the highest ones tend to warble. Of about 10 octaves available, only about half are really usable for music — but that is not bad for a simple sound device such as this.

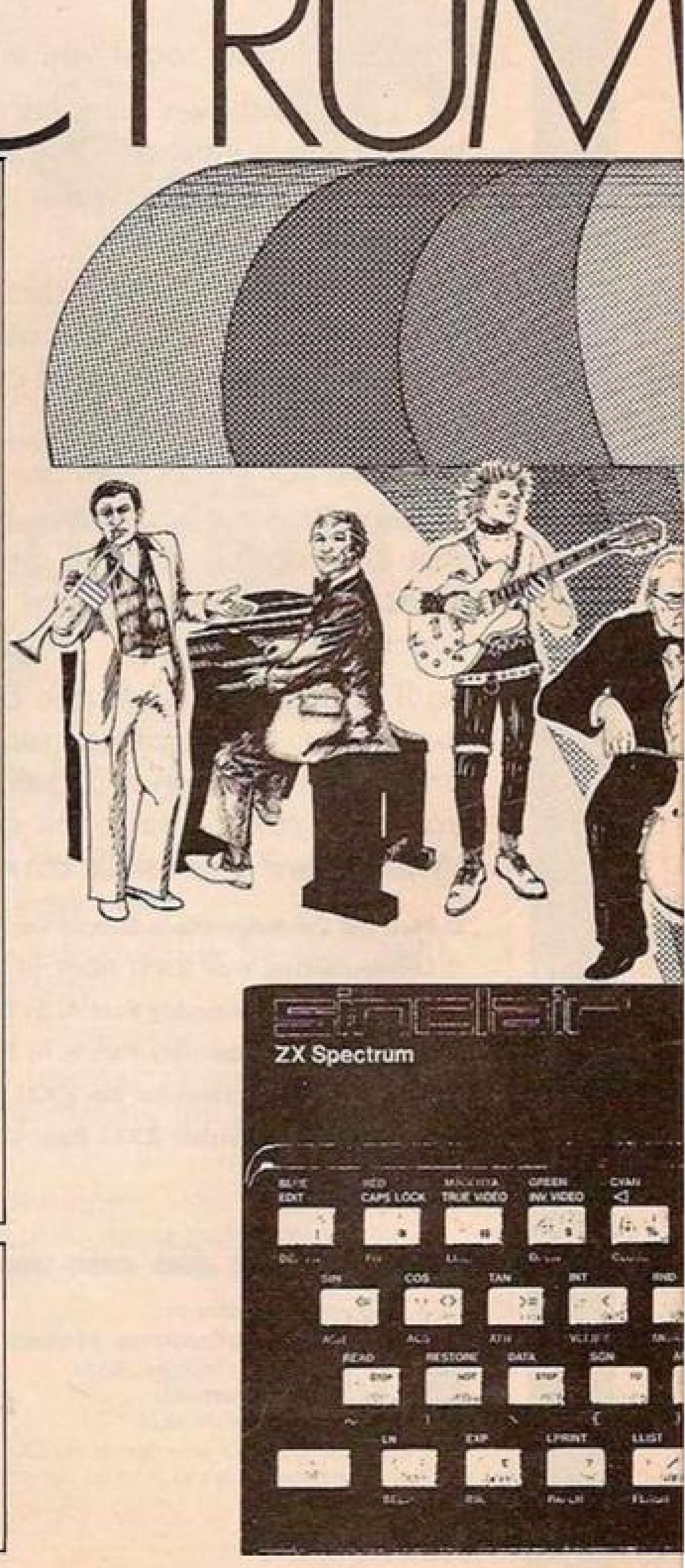
My main worry was that it was far from convenient to always position my TV, Spectrum and equipment near my hi-fi. It was also a major nuisance having to plug and unplug the cassette recorder whenever I wanted to load a program, or save one on to tape.

Enough of the criticisms — what can you do with the Beep command? Of course, it is possible to program simple tunes with it. The Spectrum manual suggests that you draw out staves and bar lines for music and having written your tune, you can make a note of the numbers which correspond to each note's pitch and duration. Yet that is not easy and presumes, perhaps wrongly, that you know something about writing music in notation.

```
  1 REM Composer © Tim Langdell
  2 DIM d(50): DIM n(50)
  3 LET r=0: LET y=1
  4 BORDER 5: PAPER 1: INK 9: CLS
 10 PRINT "Enter your music by putting the note first  and then   it's duration."
 15 PRINT '"You have two octaves starting  at middle C."''"Enter C  to  G  for  the  lower octve, c to g is the higher one."
 16 PRINT '"You put it all in one line!(eg: c1e1f1d1)"
 17 REM Duration 1 is one beat, 2 is two beats, etc.
 20 INPUT a$
 30 FOR s=1 TO LEN a$ STEP 2
 31 IF CODE a$(s)<97 THEN GO TO 100
 32 IF a$(s)="e" THEN LET r=1
 33 IF a$(s)="f" THEN LET r=1
 34 IF a$(s)="a" THEN LET r=-.5
 35 IF a$(s)="d" THEN LET r=.5
 36 IF a$(s)="g" THEN LET r=1.5
```

How much better it would be if you could just play the Spectrum like an organ, or type in notes as letters rather than complex Beep commands. The listings in programs 1 and 2 allow you to do these two things. The first program simply uses the Inkey$ command to read the keyboard. If you press key T it plays middle-C, key Y is a tone up, and so on. I leave you to improve the program's elegance and

SPECTRUM




```
  1 REM ORGAN:© Tim Langdell
  2 BORDER 1: PAPER 4: INVERSE 1: CLS
  3 PRINT "Chose one of three octaves; type "m" to have middle C  on the  T  key, "u"for an octave higher, and "d" for one lower."
  4 INPUT q$: IF q$="m" THEN LET k=0
  5 IF q$="u" THEN LET k=12
  6 IF q$="d" THEN LET k=-12
  7 CLS
  8 INPUT "Want vibrato?";v$
  9 IF v$="y" THEN GO TO 11
 10 LET x=0.3: GO TO 15
 11 LET x=0.03
 15 PRINT ; PAPER 0; INK 6;AT 3,4;"Q";AT 3,6;"W";AT 3,8;"E";AT 3,10;"R";AT 3,12;"T";AT 3,14;"Y";AT 3,16;"U";AT 3,18;"I";AT 3,20;"O";AT 3,22;"P";AT 10,4;"↑ The keyboard layout↑"
 16 REM Use inv. video  to get inverse numbers:
 17 PRINT AT 2,5;"2";AT 2,7;"3";AT 2,9;"5";AT 2,13;"6";AT 2,15;"7";AT 2,19;"9";AT 2,21;"0"
 20 IF INKEY$="a" THEN STOP
 21 IF INKEY$="t" THEN BEEP x,0+k
 22 IF INKEY$="6" THEN BEEP x,1+k
 23 IF INKEY$="y" THEN BEEP x,2+k
 24 IF INKEY$="7" THEN BEEP x,3+k
 25 IF INKEY$="u" THEN BEEP x,4+k
 26 IF INKEY$="i" THEN BEEP x,5+k
 27 IF INKEY$="9" THEN BEEP x,6+k
 28 IF INKEY$="o" THEN BEEP x,7+k
 29 IF INKEY$="0" THEN BEEP x,8+k
 30 IF INKEY$="p" THEN BEEP x,9+k
 31 IF INKEY$="r" THEN BEEP x,-1+k
 32 IF INKEY$="4" THEN BEEP x,-2+k
 33 IF INKEY$="e" THEN BEEP x,-3+k
 34 IF INKEY$="3" THEN BEEP x,-4+k
 35 IF INKEY$="w" THEN BEEP x,-5+k
 36 IF INKEY$="2" THEN BEEP x,-6+k
 37 IF INKEY$="q" THEN BEEP x,-7+k
 40 GO TO 20
```

Program 1.

```
  1 REM   Frequency envelope
          © Tim Langdell
  2 BORDER 3: PAPER 6: CLS
 10 INPUT "Start frequency?";f
 11 REM Try f=0
 20 INPUT "Interval?";i
 21 REM Try i=1
 30 INPUT "End frequency?";fe
 31 REM Try fe=3
 40 FOR a=f TO fe STEP i
 50 DRAW 20*i,10*a: BEEP 0.03,a
 60 NEXT a
 70 DRAW 20,0: BEEP 0.2,fe
 80 FOR w=fe TO f STEP -i
 90 DRAW 20*i,-10*w: BEEP 0.03,w
100 NEXT w
```

Program 3.

```
  40 LET n(y)=(CODE a$(s)-67)+(2
*r)
  41 LET y=y+1
  42 LET r=0
  43 NEXT s
  45 LET y=1
  50 FOR x=2 TO LEN a$ STEP 2
  60 LET d(y)=VAL a$(x)/2
  65 LET y=y+1
  70 NEXT x
  80 GO TO 200
  90 STOP
 100 IF a$(s)="F" THEN LET r=.5
 101 IF a$(s)="G" THEN LET r=.5
 102 IF a$(s)="B" THEN LET r=-.5
 103 IF a$(s)="A" THEN LET r=-.5
 104 LET n(y)=(CODE a$(s)-67-r)*
2
 105 LET r=0
 106 LET y=y+1
 110 GO TO 43
 200 FOR t=1 TO LEN a$/2
 210 BEEP d(t)/2,n(t)
 220 NEXT t
```
Program 2.

find a way to vary the duration of each note. You can store your tune for later play-back. Why not program in two keyboards as on a double manual organ?

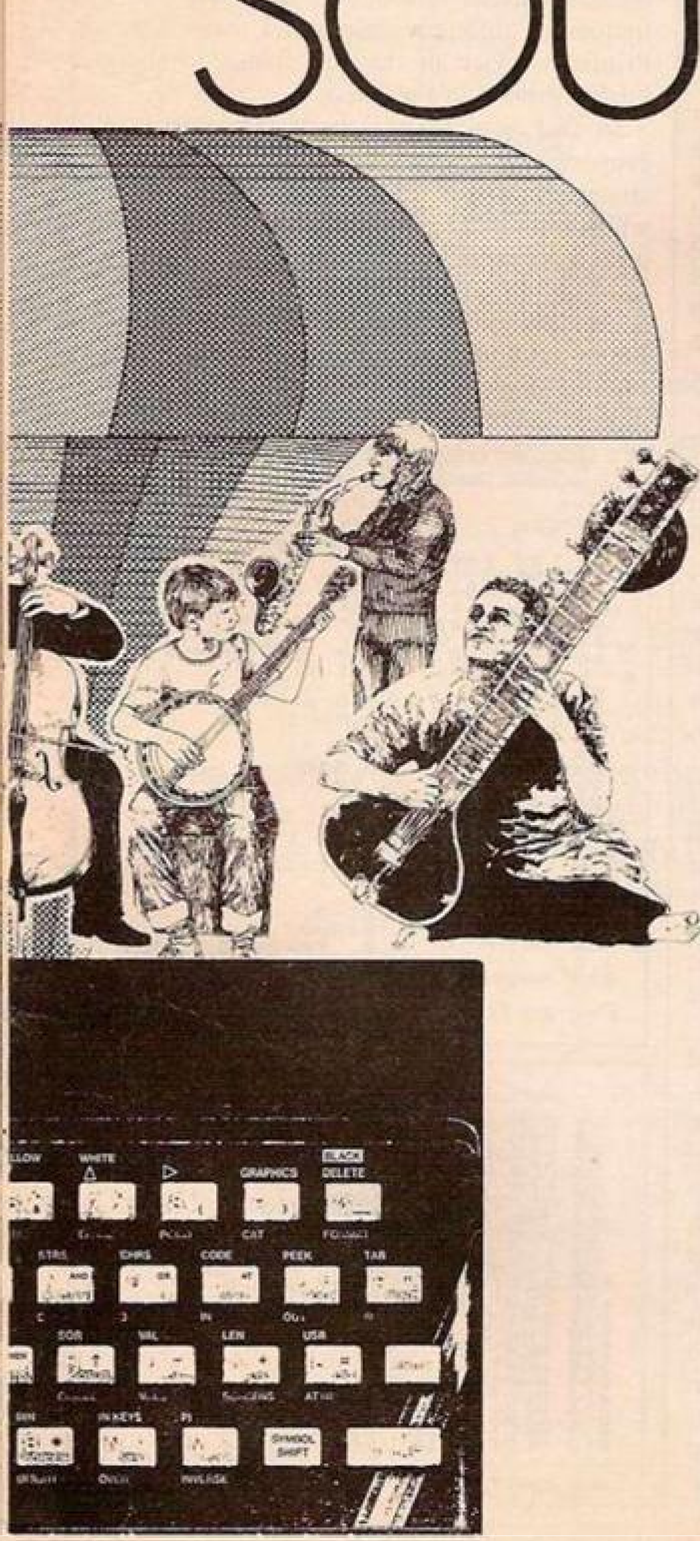
The Spectrum allows you to program fract-tional changes in pitch. You could use this capability to tune your "organ" to another instrument, and you could also create other scales than the so-called even-tempered one obtained by Beeping whole pitch values. You can even create scales for oriental music which uses more than just eight tones in a scale.

The second program allows you to type the notes as letters and the duration as numbers of beats — alternating notes and durations. This allows you to forget about the Beep command altogether and you no longer have to calculate what number the Spectrum recognises as which pitch. I have made upper-case letters stand for the notes from middle-C to the G above, and lower-case letters are for the next octave. You can, of course, alter this to your taste.

I have also made the basic beat half a second, which you can easily alter, too. Notice that you are entering your whole tune into a single string, so if you want you could save your masterpiece on cassette — remembering to use Goto and not Run upon reloading or you will clear your string.

Unlike the BBC machine, the Spectrum is not equipped for sound synthesis. So if you have used a ZX-81 with either the Stuart or Quicksilver sound board, you will be very disappointed with the Spectrum's abilities. The

SOUNDS




```
  1 REM    duration/frequency
       envelope:© Tim langdell
  2 BORDER 2: PAPER 4: CLS
 10 LET i=0.05
 20 FOR f=0 TO 2 STEP 0.5
 30 BEEP i,f: DRAW 300*i,20*f
 40 LET i=i-0.005
 50 NEXT f
 60 DRAW 50,0: BEEP 0.5,2
```
Program 4.

```
   1 REM    Man climbs ladder
            © Tim Langdell
   2 REM to create man CHR$
   3 BORDER 4: PAPER 6: CLS
  10 POKE USR "p", BIN 00011000
  20 POKE USR "p"+1,BIN 00100100
  30 POKE USR "p"+2,BIN 10011001
  40 POKE USR "p"+3,BIN 01111110
  50 POKE USR "p"+4,BIN 00011000
  60 POKE USR "p"+5,BIN 01100100
  70 POKE USR "p"+6,BIN 10000100
  80 POKE USR "p"+7,BIN 00000100
  90 REM Second man for movement
 100 POKE USR "u", BIN 00011000
 110 POKE USR "u"+1,BIN 00100100
 120 POKE USR "u"+2,BIN 10011001
 130 POKE USR "u"+3,BIN 01111110
 140 POKE USR "u"+4,BIN 00011000
 150 POKE USR "u"+5,BIN 00100110
 160 POKE USR "u"+6,BIN 00100001
 170 POKE USR "u"+7,BIN 00100000
 200 REM Draw ladder
 210 LET x=BIN 01000010
 220 POKE USR "a",x
 230 POKE USR "a"+1,x
 240 POKE USR "a"+2,BIN 01111110
 250 POKE USR "a"+3,x
 260 POKE USR "a"+4,x
 270 POKE USR "a"+5,x
 280 POKE USR "a"+6,BIN 01111110
 290 POKE USR "a"+7,x
 300 FOR t=0 TO 21
 310 PRINT AT t,10;"A": REM This
is the graphic chr$ on key "A"
 320 NEXT t
 330 LET x=0: LET y=21: LET z=-1
 340 FOR n=y TO x STEP z
 350 PRINT AT n,10;"P": PAUSE 2-
z: PRINT AT n,10;"U"
 355 PAUSE 2-z
 360 REM These are graphic chr$
remember!
 370 PRINT AT n,10;"A"
 380 IF ABS z=2 THEN GO TO 500
 390 BEEP 0.02,30: BEEP 0.02,40
 400 NEXT n
 410 LET k=x: LET x=y: LET y=k:
LET z=-2
 420 GO TO 340
 500 BEEP 0.01,(40-(n/2))
 510 NEXT n: GO TO 330

   1 REM Bomb drop© Tim langdell
   2 REM AN EXRERNAL AMPLIFIER
WILL HELP
  10 LET x=0.3
  20 FOR N=69 TO 55 STEP -x
  30 BEEP 0.05,N
  40 LET x=x+0.1
  50 NEXT N
  60 REM Explosion(?)
  70 FOR K=0 TO 20
  80 BEEP 0.01,-10: BEEP 0.01,-5
0: BEEP 0.01,-60
  90 NEXT K

   1 REM Phasor 2 © Tim langdell
  10 LET x=0.0125
  20 BEEP x,4: BEEP x,6: BEEP x,
8: BEEP x,10: BEEP x,12: BEEP x,
14: BEEP x,16: BEEP x,4: BEEP x,
6: BEEP x,8
  30 PAUSE 0: REM Waits for key
press.
  40 GO TO 10
```
Program 5.

```
   1 REM     Muscript
          ©Tim Langdell
   2 PAPER 1: INK 5: BORDER 6: C
LS
  10 PLOT 0,151 : DRAW 255,0
  20 PLOT 0,143: DRAW 255,0
  30 PLOT 0,135: DRAW 255,0
  40 PLOT 0,127: DRAW 255,0
  50 PLOT 0,119: DRAW 255,0
  60 REM HALF BEAT NOTE
  70 LET X= 0
  80 LET Y=BIN 00000100
  85 LET Z=BIN 01111100
  90 POKE USR "E",X
 100 POKE USR "E"+2,BIN 00000111
 110 POKE USR "E"+3,BIN 00000101
 120 POKE USR "E"+1,Y
 130 POKE USR "E"+4,Y
 140 POKE USR "E"+5,Y
 150 POKE USR "E"+6,Y
 160 POKE USR "E"+7,Y
 170 POKE USR "C",X
 180 POKE USR "C"+1,BIN 00111100
 190 POKE USR "C"+2,Z
 200 POKE USR "C"+3,Z
 210 POKE USR "C"+4,Z
 220 POKE USR "C"+5,BIN 00111000
 230 POKE USR "C"+6,X
 240 POKE USR "C"+7,X
 250 PRINT OVER 1;AT 3,3;"E";AT
4,3;"C"
 260 REM These are the chr$ on
keys E and C.
 270 BEEP 0.25,12
```
Program 6.

Spectrum can only produce a tone, composed of a series of clicks, and maintain the tone for a specified time.

With a sound board, and with other micros, you can alter the quality of the sound, change how fast the note builds up in frequency, or how fast it dies away — known as the frequency envelope. With the Spectrum you are limited to finding uses for the change in quality of the sound from clicks to warbles and simulating sound envelopes.

Programs 3 and 4 are examples of how you might experiment with frequency and duration envelopes. Such things are made possible by the fact that the Spectrum can accept fractions of a second for duration, and fractions of a semitone for pitches.

By experimenting with a variety of fractional changes in pitch and duration you can use For-Next loops to ramp up to a given tone, and ramp down from it again. Note in the examples in programs 3 and 4 that there are two ways you can speed up the transition from one pitch to the next; either by reducing the duration of the intermediary pitches, or by increasing the value of the Step command in the loop.

The former leads to a rather less musical sound, but the latter gives less smooth ramping. You will have to experiment with the values before arriving at useful sound shapes. Be warned, though, you will not be able to produce sounds in this manner which will match those from a synthesiser.

Program 5 illustrates how you can use the Spectrum to give sound effects for games. I have included a man-climbing-a-ladder routine, a bomb drop, and a phasor sound. None of these is up to arcade game standards, but can give you a useful added dimension to your games. Note that the bomb drop has the pitch descending rapidly from around 60 to 50, with the steps increasing in length as the bomb falls to give the impression that it is speeding up.

Program 6 shows a routine which uses the user-definable graphics facility to make pictures of notes on staves. It would be easy to extend this idea so that notes typed in with the Spectrum acting as an organ or as letters could be displayed as notes graphically. Key signatures and clefs could also be shown.

The next listing, program 7, gives a glimpse of how you might link sound and colour on

(continued on next page)

(continued from previous page)

your Spectrum. It plays a random tune, plotting random colours as it does so.

My general conclusion must be that the Spectrum's sound is very limited and poorly designed. The fact that the sound is so very quiet using the internal speaker alone is very annoying. The sound is also used to give auditory feedback that a key has been pressed, although at switch-on the click made cannot really be heard.

You can alter the pitch of the keyboard beep by Poking location 23609, and I suggest that you try a value around 100. This gives a pleasant tone which can just be heard. This facility can be very useful when typing in large amounts of data. But it is a great pity that this keyboard beep is also amplified along with the sound if you add an external amplifier. The effect is very annoying when Inputting data into a program which is using the sound facility.

To avoid these beeps on your stereo, you would need to go through the tiresome routine of unplugging and plugging your jack plugs from the Spectrum. Perhaps Sinclair might consider making the keyboard sounder and the beep facility separate circuits on a later model, but certainly the company must think about making the internal amplifier much more powerful.

The Spectrum's sound is one of its more disappointing aspects, but with perseverance you will be able to put it to good use in games.

Let us now explore some more facets of this machine's colour graphics.

How many colours in a Spectrum? Seven, if you think of a rainbow? Or perhaps eight, if you accept Sinclair's insistence that black and white are colours? How about 64 or even 128 though? Well, it is possible to obtain considerably more than the basic eight colours on a Spectrum. The trick is to use a user-defined graphic which is like a miniature chess board in appearance, or to draw diagonal crosshatch lines across your TV "page" using the draw command.

Program 8 shows how to create the graphic

```
   1 REM      Interference
            © Tim Langdell
   2 BORDER 0
  10 LET I=INT (5*RND)+1: LET P=
INT (5*RND)+1
  15 IF I=P THEN GO TO 10
  20 INK I: PAPER P: CLS
  30 FOR A=0 TO 255 STEP 2
  40 PLOT 128,88: DRAW -127+A,-8
7
  50 NEXT A
  60 FOR B=0 TO 175 STEP 2
  70 PLOT 128,88: DRAW 127,-87+B
  80 NEXT B
  90 FOR C=0 TO 255 STEP 2
 100 PLOT 128,88: DRAW 127-C,87
 110 NEXT C
 120 FOR D=0 TO 175 STEP 2
 130 PLOT 128,88: DRAW -127,87-D
 140 NEXT D
 150 PAUSE 200: GO TO 10
```

Program 9.

```
  10 REM        Kalidos
            © Tim Langdell
  20 LET A$="█"
  30 PAPER 7: CLS
  40 LET Y=INT (16*RND)
  50 LET X=INT (11*RND)
  60 LET Z=INT (8*RND)
  70 GO SUB 90
  80 GO TO 40
  90 IF Z=0 OR Z=7 THEN GO TO 15
0
 100 PRINT INK Z;AT 11-X,16+Y;A$
 110 PRINT INK Z;AT 11-X,16-Y;A$
 120 PRINT INK Z;AT 11+X,16+Y;A$
 130 PRINT INK Z;AT 11+X,16-Y;A$
 140 RETURN
 150 PRINT INVERSE 1;AT 11-X,16+
Y;A$
 160 PRINT INVERSE 1;AT 11-X,16-
Y;A$
 170 PRINT INVERSE 1;AT 11+X,16+
Y;A$
 180 PRINT INVERSE 1;AT 11+X,16-
Y;A$
 190 GO TO 40
```

Program 10.

```
   1 REM    Musicolage
           © Tim langdell
  10 BORDER 1
  20 LET NOTE=RND*20
  30 LET DUR=RND*0.5
  40 LET I=(RND*6)+1
  50 PRINT INK I;AT 20-NOTE,60*D
UR;"█"
  60 BEEP DUR,NOTE
  70 GO TO 20
```

Program 7.

```
   1 REM    128 colours
          ©Tim Langdell
   5 REM CHEKER PATTERN
  10 FOR A=0 TO 6 STEP 2
  20 POKE USR "A"+A,BIN 01010101
POKE USR "A"+A+1,BIN 10101010
  30 NEXT A
  40 FOR P=0 TO 7
  50 FOR I=0 TO 7
  60 FOR B=0 TO 1
  70 PRINT PAPER P; INK I; BRIGH
T B;"AA";P;I;: NEXT B
  80 NEXT I: NEXT P
  90 REM Full page colour
 100 FOR P=0 TO 7: FOR I=0 TO 7:
 FOR B=0 TO 1
 110 FOR Y=0 TO 31
 120 PRINT PAPER P; INK I; BRIGH
T B;"AAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAA";
 130 NEXT Y
 140 POKE 23692,255: REM AUTO
SCROLL
 150 NEXT B: NEXT I: NEXT P
```

Program 8.

character needed and demonstrates how you can mix the standard eight colours in pairs of adjacent pixels so that more than 100 colours or hues can be obtained. The second part of the program runs through the colours again, but this time each colour fills a video page — which gives a better colour result. You can Print Over these colours as you would the normal eight.

The Spectrum is also capable of some rather fancy pictures which resemble interference patterns in light. Program 9 gives an example of this, and randomly changes the Paper and Ink colours. You might try removing the CLS command so that the new Ink and Paper are written over the previous ones. This also gives a clear demonstration of the fact that you can draw in the 176 by 256 resolution, but colour is set at the 32 by 22 character-space level.

It is very interesting to see in this last program how one of the Spectrum's shortcomings can be an asset. You may have heard some people refer to the rather marked "dot crawl" on the Spectrum. This means that when you draw a few lines of one colour on top of paper of another colour, then the Ink lines seem to shimmer rather than being absolutely steady. In the last example, and in others too, this shimmering effect adds a very interesting dimension to the colour display.

Program 10 is a form of kaleidoscope using the graphics character obtained by pressing Shift 9 followed by Shift 8. The Ink of this is varied at random and the blocks of colour are printed symmetrically in four places around the screen. Lines 90 and 150 onwards rub out some of the pattern to avoid crowding — and make it more interesting.

The next program, number 11, I have called Snowflake. Lines 60 to 180 draw the snowflake and the other lines allow a new feature on the Spectrum to be realised. Usually the only way to change the Paper colour is to type in Paper x, where x is a number between 0 and 7, followed by CLS. This of course wipes off any pattern you had on the screen. By creating a string of spaces sufficient in number to fill the whole screen you can use the Print Over 1 command to change the Paper without destroying the pattern.

In this program the Paper is changed in this way at random. There is an alternative method for changing the Paper while retaining the graphics by Poking the memory locations between 22528 and 23231 — the next 64 bytes refer to the bottom two lines of screen where the program is entered. These locations contain the attribute codes for the character positions on the screen. So if the position 0,0 is cyan, Paper 5, then Peek 22528 would return (8*5) 40.

You would need to use the Int command to determine the Paper colour already present. For example:

INT((PEEK a)/8) = colour code

where "a" is the address. You would then substract 8* this value from "Peek a" and add 8* the code of the new colour to "Peek a".

Program 12 demonstrates a rather puzzling feature of the Spectrum. When I was trying to draw lines of the same colour across the television screen I discovered that although I only specified one colour, two were drawn on occasions. This program shows that what colours are drawn when only one has been requested depends on which Paper colour the lines are drawn against.

The first lines are two pixels apart whereas the lower lines are three apart. As you see, the upper ones are usually in the same, requested, colour whereas the lower lines are most frequently different colours. I have Over Printed a block of the Ink colour to show further aspects of the effect.

So that you do not think that this is a property of drawing lines across a single character square, I have included four lines which are first an even number and then an odd number of pixels apart. Whenever the lines are an odd distance apart, two colours occur. Moreover, the earlier demonstration shows clearly that you can draw more than one Ink in a single character square. This *is* a fault though, and I can see no way of drawing lines of a specified colour and position consistently.

```
   1 REM       Snowflake
            © Tim Langdell
  10 LET T=0
  20 INK 7: PAPER 3: CLS
  30 LET A$=" ": LET B$=" ": REM
 both single spaces
  35 REM Creates screen full of
spaces
  40 FOR K=0 TO 702: LET B$=B$+A
$: PRINT "0";: NEXT K
  50 CLS
  60 FOR A=20 TO 80 STEP 10
  70 LET U=0: LET R=PI
  80 LET N=100
  90 LET X=(R-U)/N
 100 FOR J=U TO R STEP X
 110 LET E=A*COS (6*J)
 120 LET X=E*SIN J
 130 LET Y=E*COS J
 140 PLOT 128+X,88+Y
 150 NEXT J
 160 LET T=T+1: IF T=101 THEN GO
TO 180
 170 GO TO 110
 180 LET T=0: NEXT A
 190 LET C=INT (6*RND)+1
 200 PRINT AT 0,0; PAPER C; OVER
1;B$
 210 PAUSE 50: GO TO 190
```

Program 11.

```
   1 REM 2 INKS PER CHR$ SQUARE?
   2 REM      © TIM LANGDELL
  10 BORDER 1: CLS
  20 FOR P=0 TO 7
  30 FOR I=0 TO 7
  40 IF I=P THEN NEXT I
  50 INK I: PAPER P: CLS
  60 PLOT 0,100: DRAW 255,0
  70 PLOT 0,98: DRAW 255,0
  90 PRINT OVER 1;AT 9,5;"██"
 100 PLOT 0,70: DRAW 255,0
 110 PLOT 0,67: DRAW 255,0
 120 PRINT OVER 1;AT 13,10;"██"
 130 PAUSE 100
 140 NEXT I
 150 NEXT P
 200 PAPER 2: INK 5: CLS
 210 PLOT 0,110: DRAW 255,0
 220 PLOT 0,90: DRAW 255,0
 230 PLOT 0,30: DRAW 255,0
 240 PLOT 0,15: DRAW 255,0
```

Program 12. ■

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```
 5 PAPER 0: CLS : BORDER 0
10 FOR X=0 TO 255
20 PLOT X,0
30 DRAW OVER 1;255-X*2,175
40 NEXT X
50 FOR Y=0 TO 175
60 PLOT 0,Y
70 DRAW OVER 1;255,175-Y*2
80 NEXT Y: REM © J. Ruston
```

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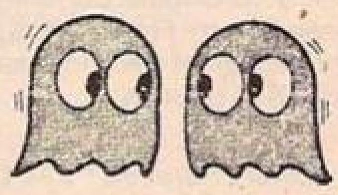
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The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess. Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Club Record Controller plus blank tape on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Program – VU-CALC.
Description – Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-FILE. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

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	G14: Flight Simulation	43	£5.95	
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	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
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NSA 11

CAN YOU ESCAPE the Demon's Domain? You must find your way through a maze where you are confronted by all sorts of dangers. Unsavoury characters and gruesome tests conspire to ensure that you never gain your freedom.

The program is written with a master program and nine different subroutines. Each subroutine counts as one danger. When Move is displayed in the top right-hand corner of the screen you move around the maze by using the cursor keys, 5 to move left, 6 to move down, 7 to move up, and 8 to move right.

Demon's Domain can be made more fun by adding your own dangers. Here are a few hints if you want to customise the program.

Line 520 indicates the number of danger routines in the program. At the moment the number is 9, one for each subroutine. Therefore, if another routine were added the number would have to be altered to 10.

Each routine goes up in steps of 500. 1000 is the first routine, 1500 the second and so on. Therefore, another routine must start at 500 more than the last one. The last danger routine currently starts at 5000.

The routine at line 50 gives quite a long delay, then clears the screen. This is useful when instructions are printed at the beginning of each routine.

If a player passes the danger, he goes to either line 140 or line 200. Line 140 gives a delay, clears the screen, before going on to line 200. If he fails to negotiate the danger he goes to line 9995. This is the lose routine.

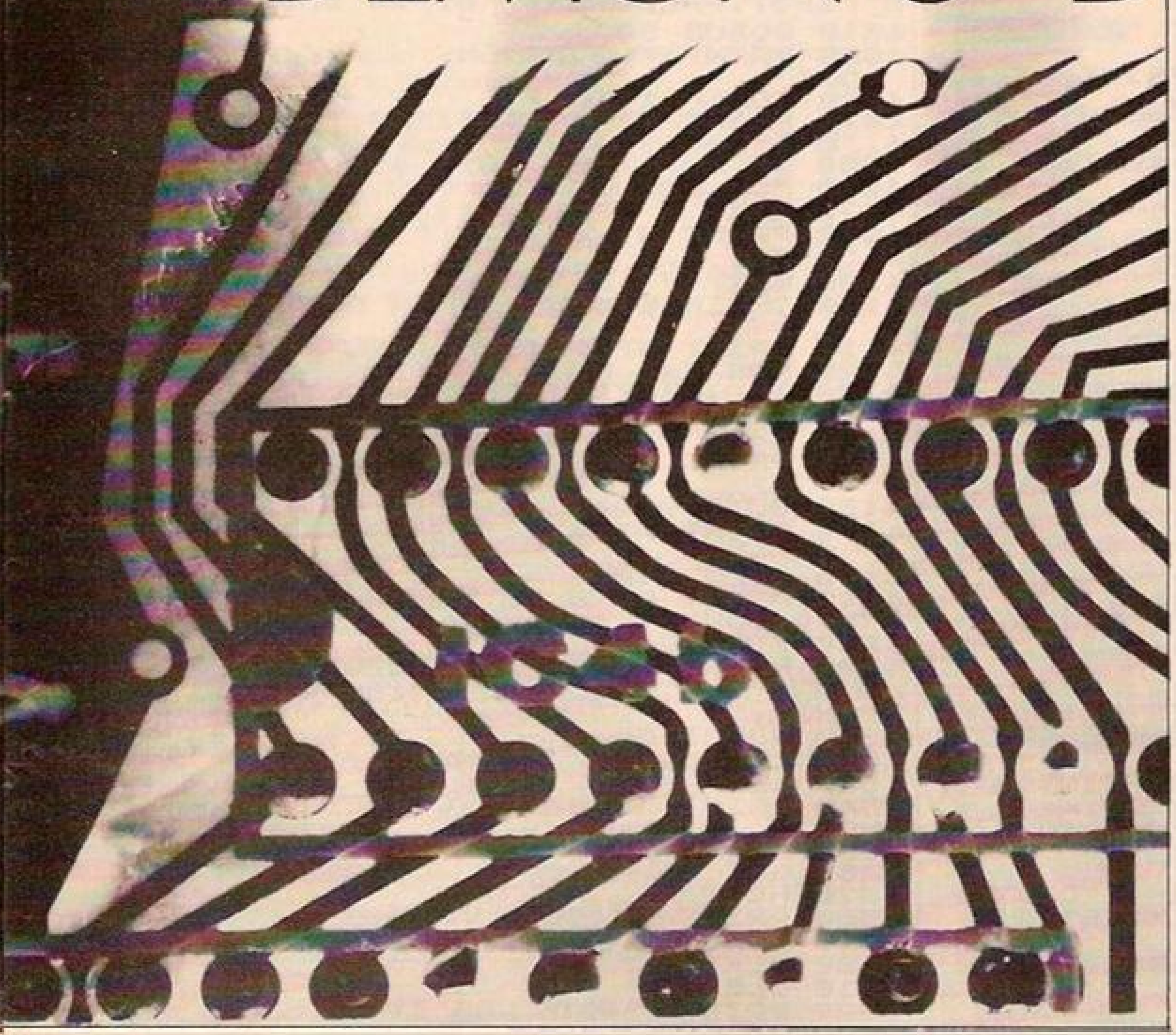
The program structure.

Line	Description
2-40	Initialise
50-80	Delay subroutine
100-140	Print instructions
200-290	Print domain
300-570	Make move
	Check for a win
	Witch Edna routine
	Fall into an abyss routine
1000-1170	The egotistical-gorilla routine
1500-1640	Hail of barbs routine
2000-2190	The mad mathematician
2500-2700	The doors routine
3000-3120	The crusher routine
3500-3690	The gruesome-gambler routine
4000-4200	Baron McDread routine
4500-4670	The maniacal memory-tester routine
5000-5260	Demon-driver routine
9995-9999	Lose routine



```
   1 REM DEMONS DOMAIN
   2 SLOW
   3 RAND
  10 LET A=11
  20 LET B=0
  30 LET C=0
  40 GOTO 100
  50 FOR E=1 TO 200
  60 NEXT E
  70 CLS
  80 RETURN
 100 PRINT "THE DREADED DEMONS D
OMAIN"
 110 PRINT ,,,,,,"THE SHORTEST R
OUTE MAY NOT",,"BE THE BEST,"
 120 PRINT ,,,,,,"YOU MAY ONLY M
OVE NORTH SOUTH",,"OR EAST,"
 130 PRINT ,,,,,,"ABANDON HOPE A
LL YE WHO ENTER."
 140 GOSUB 50
 200 PRINT "DEMONS DOMAIN"
 210 PRINT ,,,,,,,,"        ▒▒▒▒▒▒
▒▒▒▒▒▒"
 220 FOR E=1 TO 5
 230 PRINT "         ▒  ▒  ▒  ▒"
 240 NEXT E
 250 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒",",        ▒       ▒       ▒▒▒EXIT
"
 260 FOR E=1 TO 4
 270 PRINT "           ▒      ▒
▒"
 280 NEXT E
 290 PRINT "           ▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒"
 300 PRINT AT A,B;"▒"
 310 PRINT AT 0,25;"MOVE"
 320 IF INKEY$<>"" THEN GOTO 320
 330 LET A$=INKEY$
 340 IF A$<"6" OR A$>"8" THEN GO
TO 330
 350 PRINT AT 0,25;"    ";AT A,B
;"▒"
 360 LET A=A+(A$="6")-(A$="7")
 370 LET B=B+(A$="8")
 380 PRINT AT A,B;
 390 LET D=PEEK (PEEK 16398+256*
PEEK 16399)
 395 IF D<>136 THEN GOTO 530
 400 PRINT "▒"
```

DEMON'S DOMAIN



Once you have taken the first step on your journey through Demon's Domain there is no turning back — and only your wits and game-playing skills will save you from the gaping abyss which awaits all those who fail. The denizens of this subterranean realm will set you fiendish tasks and torment you with the hail of barbs and the crusher. Egotistical gorillas and mad mathematicians are ready and waiting for you. All hope abandon, ye who enter Joseph Nicholson's program for the 16K ZX-81.

```
410 LET E=INT (RND*2)
420 IF E=1 THEN GOTO 500
430 LET C=C+1
440 IF C<>5 THEN GOTO 310
450 CLS
460 PRINT "THE WICKED WITCH EDN
A",,,"THINKS THAT THE GAME HAS B
EEN",,,"TOO EASY FOR YOU AND SEN
DS YOU",,,"BACK TO THE START"
470 LET A=11
480 LET B=0
485 LET C=0
490 GOTO 140
500 LET C=0
510 CLS
520 GOTO (INT (RND*9)*500)+1000
530 CLS
540 IF D=0 THEN PRINT "YOU FELL
 INTO AN ABYSS"
550 IF D=42 THEN PRINT "YOU HAV
E ESCAPED FROM",,,"DEMONS DOMAIN
.BUT NEXT TIME",,,"YOU MAY NOT B
E SO LUCKY."
560 IF D=0 THEN GOTO 9995
570 STOP
1000 PRINT "THE EGOTISTICAL GORI
LLA",,,"TELL HIM HIS NAME",,,"OR
 BE DISMANTLED.",,,"A FLASH OF L
IGHTNING",,,"REVEALS IT BRIEFLY.
"
1010 GOSUB 50
1020 LET E=INT (RND*4)
1030 IF E=0 THEN LET A$="RONALD"
1040 IF E=1 THEN LET A$="WINSTON
"
1050 IF E=2 THEN LET A$="STANLEY
"
1060 IF E=3 THEN LET A$="SIDNEY"
1070 PRINT AT 10*RND,25*RND;A$
1080 CLS
1090 PRINT "WHAT IS MY NAME ?"
1100 INPUT B$
1110 PRINT ,,"THAT IS ";
1120 FOR E=1 TO 50
1130 NEXT E
1140 IF A$=B$ THEN PRINT "RIGHT
YOU ARE SAVED"
1150 IF A$=B$ THEN GOTO 140
1160 PRINT "WRONG RIPP...CRACK..
."
1170 GOTO 9995
1500 PRINT "HAIL OF BARBS",,,,"K
EEP STILL AND HOPE."
1510 FOR E=1 TO 50
1513 NEXT E
1516 CLS
1520 PRINT AT 15,15;"■"
1530 FOR E=0 TO 21
1540 FOR F=1 TO 3
1550 PRINT AT E,RND*30;"//"
1560 NEXT F
1570 NEXT E
1580 PRINT AT 15,15;
1590 LET E=PEEK (PEEK 16398+256*
PEEK 16399)
1600 IF E=151 THEN PRINT AT 0,0;
"SAFE";TAB SQR 9+SQR 9+SQR 9
1610 IF E=151 THEN CLS
1620 IF E=151 THEN GOTO 200
1630 PRINT "UG"
1640 GOTO 9995
2000 PRINT "THE MAD MATHEMATICIA
N",,,"YOU HAVE 10 SECONDS TO ANS
WER"
2010 GOSUB 50
2020 LET A$=""
2030 PRINT "QUESTION";AT 10,0;
2040 FOR E=1 TO 8
2050 LET A$=A$+CHR$ (INT (RND*9)
+29)+"+"
2060 PRINT A$(E*2-1 TO E*2);
2070 NEXT E
2080 LET A$=A$+"0"
2090 PRINT AT 10,15;"=?"
2100 POKE 16436,255
2110 POKE 16437,255
2120 INPUT E
```

(continued on next page)

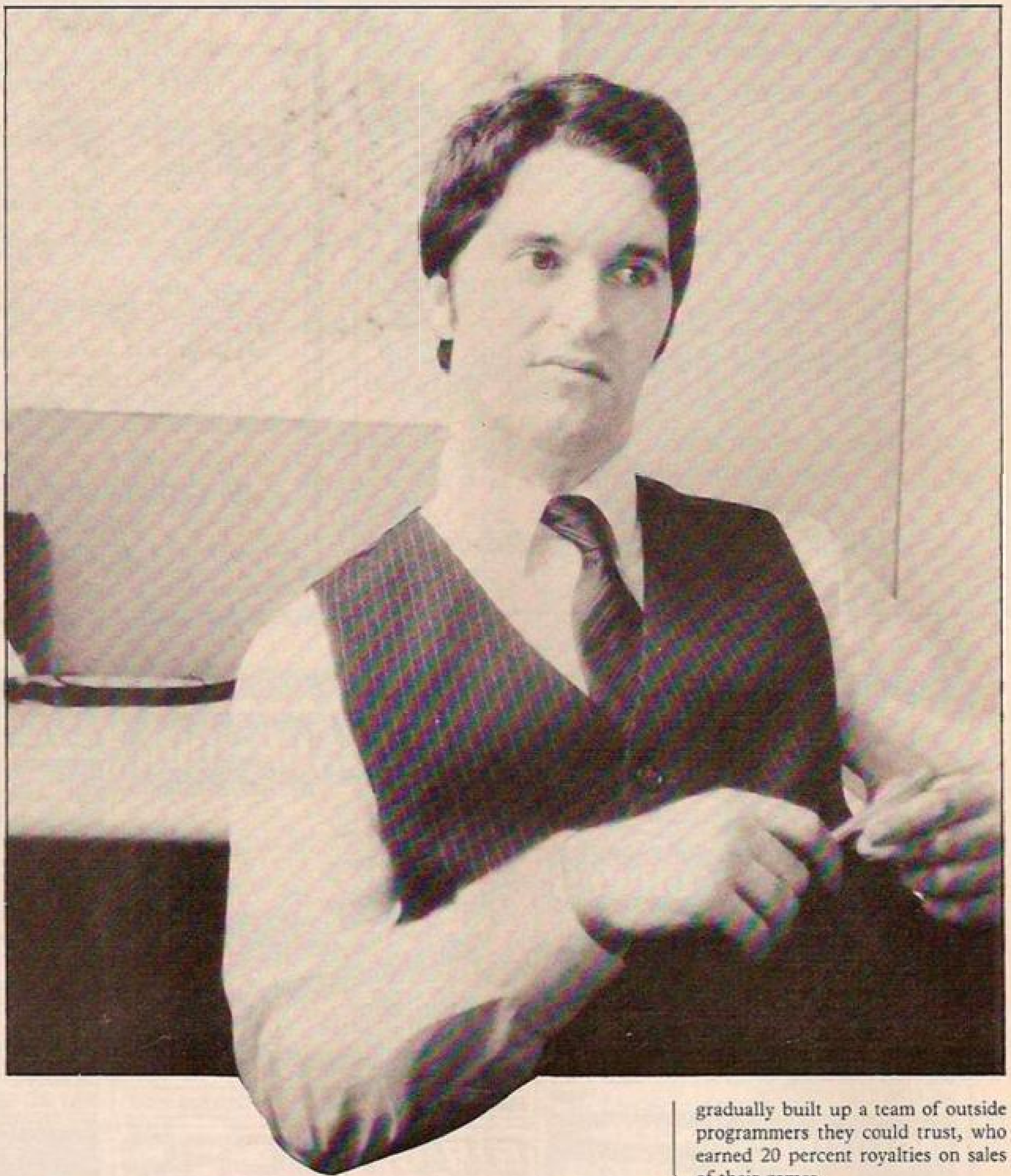
(continued from previous page)

```
2130 LET D=(65536-(PEEK 16436+(256*PEEK 16437)))/50
2140 PRINT AT 5,0;"THAT TOOK ";D;" SECONDS"
2150 IF D>10 THEN PRINT "YOU TOOK TOO LONG"
2160 IF VAL A$=E THEN PRINT AT 0,14;"CORRECT"
2170 IF VAL A$<>E THEN PRINT AT 0,14;"THAT IS WRONG"
2180 IF VAL A$<>E OR D>10 THEN GOTO 9995
2190 GOTO 140
2500 PRINT "THE DOORS",,,,"BEHIND ONE IS A STARVING LION"
2510 FOR E=0 TO 2
2520 FOR D=4 TO 11
2530 PRINT AT D,E*7+2;"▒▒▒▒▒"
2540 NEXT D
2550 NEXT E
2560 PRINT AT 13,0;"CHOOSE"
2570 IF INKEY$<>"" THEN GOTO 2570
2580 LET A$=INKEY$
2590 IF A$<"1" OR A$>"3" THEN GOTO 2580
2600 LET F=INT (RND*3)
2610 FOR E=0 TO 2
2620 FOR D=4 TO 11
2630 PRINT AT D,E*7+2;"     "
2640 IF E=F AND D=7 THEN PRINT AT D,E*7+2;"LION"
2650 NEXT D
2660 NEXT E
2670 IF F+1<>VAL A$ THEN PRINT AT 13,0;"FORTUNE HAS SMILED ON YOU"
2680 IF F+1=VAL A$ THEN PRINT AT 13,0;"WRONG CHOMP...MUNCH..."
2690 IF F+1<>VAL A$ THEN GOTO 140
2700 GOTO 9995
3000 PRINT "THE CRUSHER",,"ONLY ONE LETTER WILL STOP HIM";AT 21,15;"█"
3010 LET A$=CHR$ (INT (RND*26)+38)
3020 FOR E=2 TO 21
3030 IF INKEY$<>"" THEN GOTO 3030
3040 LET B$=INKEY$
3050 IF B$<"A" OR B$>"Z" THEN GOTO 3040
3060 IF B$=A$ THEN GOTO 3110
3070 PRINT AT E,0;"████████████████████████████████"
3080 NEXT E
3090 PRINT AT 10,3;"YOU ARE CRUSHED,",,"████";A$;" WOULD HAVE STOPPED HIM"
3100 GOTO 9995
3110 PRINT AT E-1,0;"          SAFE ";CHR$ (CODE A$+128);" HAS STOPPED HIM      "
3120 GOTO 140
3500 PRINT "THE GRUESOME GAMBLER",,,,"HAS THOUGHT OF 2 NUMBERS (1-99)",,,,"YOU HAVE TO SAY IF YOU THINK THE ",,"SECOND NUMBER IS HIGHER OR LOWER",,"THAN THE FIRST ONE."
3510 GOSUB 50
3520 LET D=INT (RND*99)+1
3530 LET E=INT (RND*99)+1
3540 IF E=D THEN GOTO 3530
3550 PRINT "THE FIRST NUMBER IS ";D,,,"IS THE SECOND NUMBER HIGHER(H)",,,,"OR LOWER(L) ?"
3560 IF INKEY$<>"" THEN GOTO 3560
3570 LET A$=INKEY$
3580 IF A$<>"H" AND A$<>"L" THEN GOTO 3570
3590 PRINT ,,"YOU THINK IT IS ";
3600 IF A$="H" THEN PRINT "HIGHER"
3610 IF A$="L" THEN PRINT "LOWER"
3620 FOR F=1 TO 50
3630 NEXT F
3640 PRINT ,,"IT IS ";E
3650 IF E>D AND A$="H" OR E<D AND A$="L" THEN GOTO 3680
3660 PRINT ,,"HURRAH YOU LOSE"
3670 GOTO 9995
3680 PRINT ,,"CURSES YOU WIN"
3690 GOTO 140
4000 PRINT "BARON MCDREAD",,,,"CHALLENGES YOU TO A DUEL.",,,"TO STAY ALIVE YOU MUST SHOOT",,,,"HIM FIRST.PRESS ANY KEY TO SHOOT"
4010 GOSUB 50
4020 PRINT "     BARON                     YOU"
4030 FOR F=1 TO 7
4040 PRINT AT 4,14-F;"█";TAB F+14;"█"
4050 IF F=7 THEN GOTO 4100
4060 FOR E=1 TO 10
4070 NEXT E
4080 PRINT AT 4,14-F;" ";TAB F+14;" "
4090 NEXT F
4100 IF INKEY$<>"" THEN GOTO 4190
4110 PRINT AT 0,12;"SHOOT"
4120 FOR F=1 TO 5
4130 IF INKEY$<>"" THEN GOTO 4170
4140 NEXT F
4150 PRINT AT 4,8;"-------------"
4160 GOTO 9995
4170 PRINT AT 4,7;"-------------"
4180 GOTO 140
4190 PRINT AT 8,0;"CHEAT  JUDGE KILLS YOU"
4200 GOTO 9995
4500 PRINT "THE MANIACAL MEMORY TESTER",,,"MEMORIZE THIS TO PACIFY HIM."
4510 GOSUB 50
4520 LET 5=INT (5*RND+5)
4530 LET A$=""
4540 PRINT "I HOPE YOU GET IT WRONG"
4550 FOR E=1 TO D
4560 LET A$=A$+CHR$ (38+25*RND)
4570 NEXT E
4580 PRINT AT 10,12;A$
4590 FOR E=1 TO 2*D+0.5*D**2
4600 NEXT E
4610 CLS
4620 PRINT "WHAT WAS IT ?"
4630 INPUT B$
4640 IF A$<>B$ THEN PRINT ,,,,B$,"WRONG"
4650 PRINT ,,,A$,"CORRECT"
4660 IF A$=B$ THEN GOTO 140
4670 GOTO 9995
5000 PRINT "DEMON DRIVER",,,,"YOU HAVE TO DRIVE",,,"YOUR CAR BETWEEN THE FIRES OF",,,"HELL,WITHOUT BURNING TO",,,"DEATH BY HITTING THEM.",,,"5 TO MOVE LEFT,8 TO MOVE RIGHT"
5010 GOSUB 50
5020 FOR D=0 TO 8
5030 PRINT AT D,10;"▒   ▒"
5040 NEXT D
5050 LET E=PEEK 16396+256*PEEK 16397+1
5060 LET F=10
5070 LET G=F+2
5080 LET D=0
5090 PRINT AT 9,F;"▒";TAB (F+4);"▒"
5100 LET F=F+INT (3*RND)-1
5110 IF F<0 THEN LET F=0
5120 IF F+4>31 THEN LET F=27
5130 LET G=G+(INKEY$="8" AND G<31)-(INKEY$="5" AND G>0)
5160 SCROLL
5170 PRINT AT 21,31;" "
5180 IF PEEK (E+G)<>8 THEN GOTO 5200
5190 GOTO 5250
5200 PRINT AT 0,G;"█"
5210 LET D=D+1
5220 IF D<40 THEN GOTO 5090
5230 PRINT AT 21,10;"SAFE"
5240 GOTO 140
5250 PRINT AT 21,10;"YOU ARE DEAD"
5260 GOTO 9995
9995 GOSUB 50
9996 PRINT "DEMONS DOMAIN",,,,
9997 FOR E=1 TO 20
9998 PRINT "CLAIMS ANOTHER VICTIM"
9999 NEXT E
```

INTERVIEW

THE BUSINESS OF M

A new recording star has emerged from the mists of the Mersey — Bug-Byte software has sold 500,000 cassette games already and doubles its sales every three months. Meirion Jones headed north to ask Tony Baden how he and Tony Milner turned a pastime into profit.



NO WONDER Tony Baden looks smug — if you had turned a student hobby into a million-pound business in just over a year so would you.

Two years ago he was studying Chemistry at Oxford when Tony Milner, a student in the next room, bought a ZX-80. They played with the machine and wrote a few programs before noticing that no-one seemed to be selling ZX-80 software.

A £3 classified advertisement paid dividends. To their surprise, the 40 cassettes they had recorded were all sold in two weeks so one night in the pub they thought up a company name, sent off the £1 fee, and Bug-Byte was born.

Tony Baden freely admits they made mistakes early on. "We had some problems but people seemed to be more tolerant in those days". The company developed into a relatively profitable sideline while they continued their studies, but they did not think a student accommodation address would sound very confidence-inspiring, so they used an address in Coventry where Tony Milner hailed from.

'We had doubled our advertising and halved our sales'

As soon as they could acquire an Atom, the pair set about writing Acorn games. From the outside the operation was beginning to look professional. "At first we pretended we were bigger than we were". Just before Christmas 1980 Bug-Byte's sales reach £150 in one week and the potential of the business became clear to them.

Early in 1981, just months from the end of their college careers, the two Tonys gambled on placing a full page advertisement for the ZX-80 tapes. Unfortunately Clive Sinclair chose the same month to launch his new ZX-81: "We had doubled our advertising and halved our sales", admits Baden.

The time had arrived for decisions. Undeterred by the advertising fiasco, they decided to become full-time partners in Bug-Byte when they left Oxford rather than pursue safe careers such as computer programming. "I'm glad I didn't", says Tony Baden. A third friend from Oxford was supposed to join them but "he never turned up".

'I wrote eight cassette games in one day once'

Tony Baden wanted to set up shop in his home town, so they moved into the Albany, Old Hall Street, Liverpool in July 1981. They quickly developed games software for the ZX-81. At first they produced all the programs themselves: "I wrote eight in one day once", but gradually built up a team of outside programmers they could trust, who earned 20 percent royalties on sales of their games.

Tony Baden has abandoned programming to concentrate on running the business, leaving Tony Milner to the joys of machine-code. The best-selling programs are still originated inside the company, which now employs 12 people with an average age of 19 — including a programmer who is just 16. Games are developed on Apples and then translated to fit particular machines.

Bug-Byte still contracts out for particular programs which it needs — say, an invader program for a new computer — and is interested in buying up innovative software ideas, for cash now rather than the royal-

AKING A MILLION

ties Bug-Byte used to offer. At the moment Bug-Byte buys games from about 20 regulars but "we always need more programmers".

At first Bug-Byte had to laboriously duplicate tapes but now after production of the originals manufacture is subcontracted under strict control. "We are so confident of the quality that we can guarantee our cassettes for a year — we don't get many returned", says Baden.

Bug-Byte is now selling 10 times as much as it was a year ago. "Our sales double every three months". He claims that the company has already sold 500,000 cassette games.

He does not have a very high opinion of the hardware manufacturers. "They've never really been helpful. We've had several problems with Acorn — we're not too happy with the BBC Micro". Bug-Byte's BBC was full of bugs when it finally arrived. As for the Spectrum: "We've had four of them — three don't work".

"We ignored the Vic for a while", Tony Baden admits. He feared that Commodore with its experience gained on the Pet would swamp the

'We've had four Spectrums — three don't work'

market with high-quality converted software. Commodore was surprisingly slow to produce an extensive range of software and when it materialised the prices were high enough to allow independent software houses to easily undercut them. Tony Baden is disappointed with the machine: "The Vic has not made the impression we expected", but he is looking forward to its successors, the Vic-10 and Vic-40/64.

Bug-Byte found it difficult to win Acorn approval for its software, and spent three months in fruitless negotiations with Sinclair to provide programs for the Spectrum. Now Sinclair plans to unleash a flood of 500 programs on to the market starting with a *Welcome* package which will be despatched with all new Spectrums from next week. Predictably Tony Baden is critical: "They are doing it the wrong way".

Baden believes that confidence must be created by building up a wide range of proven programs and then improving the packaging so that they look attractive enough to stand out on a shelf in a store. Software is moving out of the small advertisements and into your local shops. He compares his business with the record industry — it is no coincidence that Bug-Byte cassettes have acquired album-style covers. Tony Baden extols the virtues of "better advertising, better presentation". He expects home computers to be sold in different shops from what you play in them — just as most record shops do not sell record players. Of course, chain stores will soon be selling both.

The home-computer software business is losing its innocence. Bug-Byte now employs an advertising agency and is considering racy television and radio commercials.

Baden has already signed up 100 dealers and hopes to have 500 within two years. He claims that Bug-Byte "provides the best service and back-up dealers can find". Negotiations with High Street chainstores to sell software over the counter are going well. Last Christmas despite a rogue batch of "2,000 rotten tapes" Bug-Byte did well. A major winter offensive is already planned.

"This year with six months preparation, sales could be phenomenal", says Baden. The hype, at least, is reminiscent of the record industry. With manufacturers launching a new home computer every month for the foreseeable future, perhaps Tony Baden is not so rash in predicting that "every home will have one by the end of next year". The new Commodores and the Acorn Electron seem set to open up the market established by the ZX-80/81, the Atom, the Spectrum and now the Dragon. Nevertheless he believes that buyers will need to spend less to obtain the kind of machine they want. He cites the £50, 16K Binatone which will offer colour and sound.

Tony Baden expects people to spend "more on software than on hardware — at least the cost of the machine every year. In the same way that you have a record collection which costs more than your record player". He does not think the computer manufacturers will satisfy the demand. "They've very distant, so wrapped up in their hardware that they don't realise software is where it's at".

The recent Atari advertising blitz on television seems to show that some manufacturers have become aware that "software sells hardware".

So far Bug-Byte has grown almost unnoticed into a major supplier of games software, without having to rely on loans or government grants. "Just the occasional overdraft". Now Bug-Byte is having to cope with the problems that success brings in its wake.

Baden hopes it will not be necessary to move too far from the Mersey: "I'd like to stay up here — I

'Every home will have a computer by the end of next year'

like Liverpool — but we may open a London office". He does not see why companies who make anything to do with computers should have to be based around Cambridge or just off the M4 to be taken seriously: "We should be judged on our products".

One group that are taking Bug-Byte seriously are software pirates. Imitation may be the sincerest form of flattery but it is not one that software publishers enjoy. Baden sees unauthorised copying of programs as a threat. Software libraries are now trying to exploit loophoes in the law to operate a lending service with cassettes.

Could you be trusted not to make a duplicate of a good game you had borrowed? Making it difficult to unlock the program does not help if a direct copy can be made on tape. Considering Tony Baden's regard for the record industry it should come as no surprise to hear that Bug-Byte is experimenting with techniques to make rerecording its own cassettes impossible.

"Software sales will be worth billions over the next few years and we intend to be undisputed market leaders", says Baden. So far Bug-Byte has avoided serious software but games alone should allow them plenty of scope in the immediate future.

The company must be a juicy target for a large group to take over. "I'm open to offers", quips Baden, "but have they got the expertise? — I don't think so".

Complete with natty waistcoat and an Osborne lying casually on a desk Tony Baden looks every inch a 1980s' boy wonder, but has it been at the cost of the 24-hour grind described by some refugees from the micro industry? "No — I've enjoyed it, I don't work all night". ■



GAMES
DUCK S

Your marksmanship will decide whether the duck has any more than just a sporting chance in David Prosser's shooting game for the unexpanded Vic.

DUCK SHOOT is a semi-serious game for the unexpanded Vic-20. The player enters an angle through which a gun is turned and then fired. The higher the angle entered, the less distance the shell will cover from the gun. The shell can be made to cover different distances by varying the angle.

This can be an educational and recreational game. Young players become aware of the use of angles even though it is just a game to them. The program makes full use of colour graphics and accompanying sound effects. The behaviour of the shells is not as straightforward as at first it may seem.

When run, the program displays the title page while waiting for the user to press the f1 key. The computer, after producing a bleeping sound 10 times, will play a tune until the f1 key is pressed at the appropriate time.

After the f1 key has been pressed, a picture appears of a duck and moon on the right-hand side of the screen. Each time the game is played the moon and duck appear in different positions. Occasionally the duck will be well over to the right and the moon well over to the left, thus with three shots it is quite easy. On other occasions the user will have to shoot very accurately for the moon may block the path of the shell to the duck.

To score a point, the shell must hit the duck on the back. If the shell hits the duck anywhere else, an appropriate sound is output followed by a comment at the top of the screen. The duck moves a random quantity of spaces.

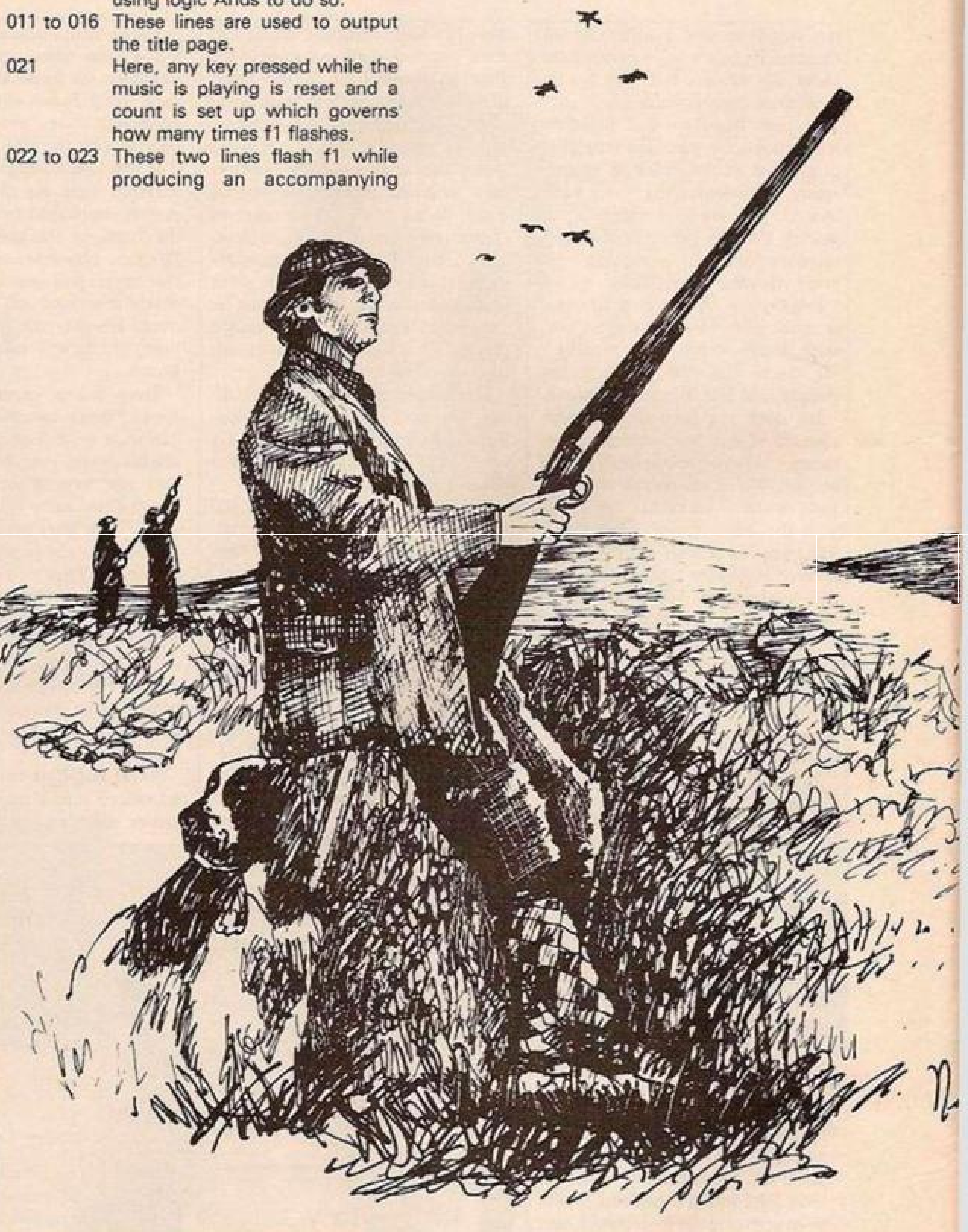
There are three shots to each game and five games are provided for. These can be changed easily by changing the lines indicated in the accompanying program documentation. If the shell hits the moon, the program automatically moves on to the next game, after producing some sound and graphics effects.

Possible improvements to the program could be made by defining your own graphics, with additional memory, to improve the detail. Instead of the present score system, you could amend it to take into account the quantity of shots which the player takes to hit the duck. Extra foul points could be implemented in case you shoot the moon. Those who feel the game is a little cruel, could change the duck into a battleship or something else. Sound effects and comments would have to be changed, but the bulk of the program would need no alterations.

Lastly, sound effects could be changed including different tunes at the beginning and throughout.

Line 300 has 89 characters in it, even though the Vic manual states only 88 are allowed per program line. This is achieved by replacing Print with its abbreviated form ?. This leaves four extra spaces at the end of the line, one of which is used for the extra character. If the line is now listed, the question mark is replaced by Print and the line uses up to 89 characters. By abbreviating in this way, much longer command lines can be created.

Line	Description
006	This sets the original screen colour to red with a red border.
007	This line sets up all the sound variable locations which are — V for the volume, S2 for the sound-box location, S3 being another sound-box location and finally NO which is the white-noise generator location.
010	The purpose of this line is to Poke coloured blocks both at the top and the bottom of the screen using logic Ands to do so.
011 to 016	These lines are used to output the title page.
021	Here, any key pressed while the music is playing is reset and a count is set up which governs how many times f1 flashes.
022 to 023	These two lines flash f1 while producing an accompanying



```
0 REM DAVID  PROSSER
1 REM   TU-4-5-82,
2 REM
3 REM
4 REM SHELDON HEATH.
5 REM
6 PRINT"▯▯":POKE36879,42
7 V=36878:S2=V-3:S3=V-2:NO=V-1
10 FORX=0TO21:POKE38400+X,(XAND7):POKE7680+X,160:POKE38884+X,(XAND7):POKE8164+X
160:NEXT
11 PRINT"▯▯▯▯▯▯▯▯▯                 ":PRINT"▯▯▯▯▯▯ DUCK  SHOOT "
12 PRINT"▯▯▯▯▯▯                  ":PRINT"▯▯▯▯▯▯     FOR      ":PRINT"▯▯▯▯▯▯
 "
13 PRINT"▯▯▯▯▯▯   VIC-20    ":PRINT"▯▯▯▯▯▯                 "
14 PRINT"▯   ▯BY DAVID  PROSSER":PRINT"     ▯SHELDON HEATH"
15 PRINT"▯▯▯▯▯▯▯▯▯▯ALABAMA":PRINT"▯▯▯▯▯▯▯▯▯▯▯▯ | ⊓ ":PRINT"▯▯▯▯▯▯▯▯▯▯▯"" ""
```

HOOT



bleeping sound to attract the user's attention.

024	Line 24 scans the keyboard and tests if the f1 key has been pressed.
026	The data pointer is reset so that the tune can be played again.
030	The quantity of games to be played is set by this line.
035	In this line the screen and border colours are changed to those used in the game, which is a green border and a purple screen.
040	The shape of the moon and of the duck.
045 to 060	Produces the rest of the picture.
070	This line controls how many attempts the user has to shoot the duck.
100	SP controls the intensity of the plot. The higher the intensity, the slower the plot is.
111	The angle at which the shell is fired is calculated here.
160	This line is used to plot each shell in a different colour.
175	TE is used as a logic variable so that if TE equals −1 the rest of the If Then statement is obeyed. If TE equals 0 then it is not.
197	This line works out the user's score in the form of a percentage so that the user can control and alter the amount of games.
210 to 215	These line flash the Y and the N on and off while also outputting a bleeping sound.
350	The colour of the duck's tail is changed three times, after the shell has hit it.
415	If the shell hits the duck on the nose or on the chest, the output is the same, the beak flashes on and off. If the shell hits the duck in the chest, then PO, the position, needs to have 22 subtracted to set PO to the position directly below the beak.
420	This line causes the duck's beak to flash.
500	This subroutine plays a tune.
600	Subroutine to move the duck.
615	Another line using logic. If T2 equals −1 then the line is obeyed otherwise the rest of the line is ignored.
700	This line makes the screen shake.

```
16 PRINT"▒▒▒PRESS <F1> TO BEGIN."
20 POKEV,15
21 POKE198,0:FORQ=1TO10
22 PRINT"█████████████████▒<F1>▒":POKES3,225:FORDE=1TO150:NEXT:PRINT"█████████████
|<F1>"
23 POKES3,0:FORDE=1TO150:NEXT
24 GETA$:IFA$=CHR$(133)THEN27
25 NEXTQ
26 GOSUB500:GOTO21
27 CD$="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒":CR$="▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶"
30 FORGAME=1TO5
35 PRINT"▒▒":POKE36879,77
40 M$="▒▒▒▒▒▒▒▒▒▒▒▒▒▒":DU$="▒▒▒▒ ▒ ▒▒▒▒▒▒ ▒":P%=RND(1)*11+9:P2%=RND(1)*8+11
45 PRINTLEFT$(CD$,19),"▒▒▒▒▒▒▒▒ ▒▒▒▒▒   ▒▒▒▒▒▒▒      ▒▒▒▒":PRINT"▒▒▒";
50 PRINT"▒▒         ▒              ▒";
55 PRINT"▒▒"LEFT$(CR$,P2%)DU$
60 PRINT"▒▒▒▒▒"LEFT$(CR$,P%)M$
65 POKEV,15
70 FORATTEMPT=1TO3
75 PRINT"▒                      "
80 INPUT"▒▒ANGLE (20-90)";AN
85 IFAN<20ORAN>90THEN75
90 POKENO,130:FORDE=1TO200:NEXT:POKENO,0
95 IFAN>86THENTE=-1
100 AG=91-AN:SP=AG/100
105 AN=AG/6.42598497
110 FORX=0TO22STEPSP
111 Y=20*SIN(X/AN)
112 POKES3,231+Y:POKEV,15-.65*Y
113 Y=22-Y
114 IFY>22THEN170
115 Y=INT(Y):Y=22*Y
120 PO=7680+X+Y:C=30720+PO
125 IFPEEK(PO)=32ORPEEK(PO)=46THEN160
130 POKES3,0:IFX<11ANDY>330THEN170
135 IFY<330THEN250
140 IFPEEK(PO)=254ORPEEK(PO)=225THEN400
145 IFPEEK(PO)=123THEN335
150 IFPEEK(PO)=160THEN231
155 GOTO180
160 POKEC,ATTEMPT:POKEPO,46
165 NEXT
170 POKES3,0
175 IFTETHENPRINT"▒▒ YOU SHOT YOURSELF !! ▒":TE=0:GOTO700
180 NEXTATTEMPT
190 NEXTGAME
195 FORDE=1TO1000:NEXT:PRINT"▒▒":POKE36879,42:PRINT"▒▒▶▶▶▶▶▶▶▶▶SCORE:▒▒▒▒"
197 PERCENT=NU/(GAME-1)*100
200 PRINT"   YOU HAVE SCORED:":PRINT"▶▶▶▶▶▶▶▶▶▒▒"PERCENT"%"
210 POKEV,15:FORQ=1TO5:PRINTLEFT$(CD$,15)"▒▶▶▶ANOTHER GO(▒Y▒/▒N▒)?";:POKES3,225
212 FORDE=1TO150:NEXT:POKES3,0:PRINT"██████Y▶N"
215 FORDE=1TO150:NEXTDE,Q:POKE198,0
216 GETA$:IFA$=""THEN216
217 IFA$="Y"THENRUN
218 IFA$<>"N"THEN210
219 END
231 PRINT"▒▒       D E A D !!      "
235 PRINTLEFT$(CD$,14)"▶▶▶R.I.P.▒▒▒▒▒▒ ▒▒▒▒ ▒▒▒▒▒▒ ▒▒▒▒ ▒ "
240 GOSUB500:NU=NU+1
245 GOTO190
250 POKEV,15
255 IFP%-P2%>-2ANDP%-P2%<3THENPRINT"▒▒ IT'S GONNA HIT ME !! ▒":FORDE=1TO1500:NE
XT:T2=-1:GOSUB600
300 FORX=5TO16:PRINTLEFT$(CD$,X)LEFT$(CR$,P%)" ▒ ▒▒ ▒▒ ▒▒▒ "LEFT$(CD$,X+1)LEFT$
(CR$,P%)M$
305 POKES3,X+237:FORDE=1TO20:NEXTDE
310 NEXT
315 POKES3,0
316 PRINT"▒▒▒    M I S S E D !!    "
320 POKENO,180:FORL=1TO1:FORM=9TO0STEP-1:POKEV,M:FORN=1TO75:NEXTN
325 NEXTM,L:POKENO,0:POKES3,0
330 GOTO190
335 PRINT"▒▒    C H E E K Y !!    "
340 POKEV,15:FORL=148TO220STEP.7:POKES2,L:NEXTL:FORL=128TO200:POKES2,L:NEXTL
345 FORL=200TO128STEP-1:POKES2,L:NEXTL:POKES2,0
350 FORI=0TO2:POKEC,I::FORDELAY=1TO500:NEXTDELAY:NEXT
355 GOSUB600:GOTO170
400 PRINT"▒▒       O U C H !!      "
405 POKEV,15:POKES2,148:FORDE=1TO200:NEXTDE:POKES2,0:FORDE=1TO60:NEXTDE
410 POKES2,128:FORDE=1TO450:NEXTDE:POKES2,0
415 IFPEEK(PO)=225THENPO=PO-22
420 FORI=1TO3:POKEPO,225:FORDELAY=1TO500:NEXT:POKEPO,254:FORDELAY=1TO500:NEXTDE
LAY:NEXT
425 GOSUB600:GOTO170
500 RESTORE
501 POKEV,15
505 FORW=1TO26+EX:READN,D
515 POKES2,N:POKES3,N
520 FORDE=1TOD*65:NEXTDE
525 POKES2,0:POKES3,0:FORDE=1TO5*D:NEXTDE
530 NEXTW:RETURN
535 DATA187,4,187,4,201,2,201,4,201,2,195,2,195,2,183,2,163,2,175,6,163,1,175,1
,183,2
540 DATA195,2,195,2,201,2,195,2,183,2,163,3,175,1,183,2,183,2,175,2,175,2,163,6
,0,12
600 PRINTLEFT$(CD$,21)LEFT$(CR$,P2%)"▒   ▒▒▒▒ ▒"
605 DI=1
610 IFP2%>15THENDI=-1
615 IFT2THENT2=0:P2%=P2%+DI*4:GOTO625
620 P2%=P2%+DI*RND(1)*4
625 PRINTLEFT$(CR$,P2%)DU$:RETURN
700 POKEV,15:FORX=15TO0STEP-.3:POKE36880,RND(1)*3+11:POKE36881,RND(1)*2+37:POKE
NO,160+X
701 FORDE=1TO10:NEXTDE,X:POKENO,0:GOTO190
```

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William Masefield's ZX-81 program effectively simulates the spread of disease and the predator-prey relationship.

A NUMBER OF programs have been published, based on Life, in which a colony of cells is made to proliferate and ultimately die off. None that I have seen does much more than this. Yet with a little extra programming, it is possible to use the basic concept of Life to create a series of ecological and epidemiological models which, while not being perfect, can be used in a classroom to illustrate some of the elementary concepts in ecology.

The first model deals with the spread of a disease in, say, a woodland plantation, and the second models the predator-prey relationship, with spiders and flies as the protagonists.

Taking the first model, the program asks for the initial number of normal, healthy trees in the plantation — a maximum of 100 — then the number of trees that may be immune to the disease — a maximum of 100 less the number of healthy normal trees — and finally the number of diseased trees — 100 less the sum of the other trees.

The program then plants these trees randomly in a 10-by-10 matrix, using a different symbol for each kind of individual. The matrix is then displayed within a black border and the numbers of each kind printed alongside, together with the cycle number, which will be zero at the start — see figure 1.

On keying Newline, the first cycle is initiated. What the program does now is to interrogate each cell of the matrix in turn to find out what kind of tree, if any, occupies it, and what its neighbours are on the north, south, east and west sides.

For our purposes, the diagonal neighbours are not considered near enough to have any influence.

This is where the ideas borrowed from Life play a role: if the number of neighbours of a normal or immune tree are three or four, then the tree is overcrowded and dies; its matrix cell is reset to zero; if the number of neighbours is less than two, then the normal and immune trees reproduce — that is, a new tree of the same kind is placed at random in an empty cell of the matrix.

However, if the cell being interrogated is occupied by a diseased tree, the disease is spread to a random matrix cell. Should that cell be empty or occupied by an immune tree, nothing happens, but if the cell has a normal tree, then that tree becomes diseased. Finally, diseased trees have a limited life-span, dying off after four cycles, whether overcrowded or not.

After interrogation of all the cells of the field, the new state of affairs is displayed, together with the counts of normal, immune and diseased trees in the field. These numbers are also stored for later display in histogram and tabular forms. The cycle is now repeated as many times as necessary until the disease dies out — which it will not do if there are no immune trees to start with, in which case the disease becomes endemic.

Figures 2 and 3 show the position after 10 and 20 cycles and figure 4 the final field for a run which started with 50 normal, 10 immune and five diseased trees. Obviously, the number of cycles will depend on the starting conditions, and on the randomness of the propagation process, but the general trend is always the same.

After cycling for the required time, the results of the experiment can be displayed as a

ECOLOGICAL MODELLING

```
   5 REM ECOLOGICAL EXPERIMENTS.
   6 REM COPYRIGHT W.R.MASEFIELD
1982
  10 CLEAR
  15 CLS
  20 PRINT TAB 5;"ECOLOGICAL EXP
ERIMENTS"
  30 PRINT
  40 PRINT TAB 9;"[illegible]
█"
  50 PRINT
  60 PRINT "SPREAD OF DISEASE IN
A"
  70 PRINT "  WOODLAND PLANTATIO
N";TAB 26;"A"
  75 PRINT
  80 PRINT "SPIDERS AND FLIES"
  90 PRINT "  (PREDATOR AND PREY
)";TAB 26;"B"
 120 INPUT A$
 125 DIM A(120)
 130 CLS
 135 LET N$="PRESS NEWLINE TO CO
NTINUE"
 140 IF A$="A" THEN GOTO 1000
 150 IF A$="B" THEN GOTO 3000
 170 STOP
 200 REM [illegible]
 210 PRINT AT 3,2;"█";AT 3,13;"█
";AT 3,15;"CYCLE NO.";AT 14,2;"█
";AT 14,13;"█"
 220 PRINT AT 18,0;N$;", H FORHI
STOGRAM, T FOR TABULATED RES- UL
TS, E FOR NEW EXPERIMENT,      I
FOR PROGRAM INDEX"
 230 FOR I=3 TO 12
 240 PRINT AT 3,I;"█";AT 14,I;"█
";
 250 NEXT I
 260 FOR I=4 TO 13
 270 PRINT AT I,2;"█";AT I,13;"█
";
 280 NEXT I
 285 PRINT AT 0,0;B$
 290 RETURN
 300 REM [illegible]
 310 FOR I=1 TO 10
 320 LET A(I)=0
 330 LET A(I+110)=0
 340 NEXT I
 350 RETURN
1000 REM [illegible]
1010 CLS
1020 LET B$="SPREAD OF DISEASE I
N A WOODLAND"
1030 PRINT B$
1035 PRINT
1040 PRINT "ENTER NO. OF NORMAL
HEALTHY      TREES (MAX. 100)";
1050 INPUT N
1060 PRINT N
1065 PRINT
1070 PRINT "NO. OF IMMUNE TREES
(MAX.";100-N;")";
1080 INPUT M
1090 PRINT M
1095 PRINT
1100 PRINT "NO. OF DISEASED TREE
S (MAX.";100-N-M;")";
1110 INPUT D
1120 PRINT D
1125 PRINT
1130 PRINT N$
1140 INPUT A$
1150 IF A$<>"" THEN STOP
1200 REM [illegible]
1210 CLS
1220 GOSUB 200
1230 DIM N(200)
1240 DIM M(200)
1250 DIM D(200)
1260 FOR J=1 TO N
1270 LET R=INT (RND*100+1)+10
1280 IF A(R)<>0 THEN GOTO 1270
1290 LET A(R)=11
1300 NEXT J
1310 IF M=0 THEN GOTO 1380
1320 FOR J=1 TO M
1330 LET R=INT (RND*100+1)+10
1340 IF A(R)<>0 THEN GOTO 1330
1350 LET A(R)=12
1360 NEXT J
1370 IF D=0 THEN GOTO 1430
1380 FOR J=1 TO D
1390 LET R=INT (RND*100+1)+10
1400 IF A(R)<>0 THEN GOTO 1390
1410 LET A(R)=13
1420 NEXT J
1430 LET C=1
1431 GOSUB 1435
1432 GOTO 1520
1435 LET I=11
1436 LET N=0
1437 LET M=0
1438 LET D=0
1440 FOR J=4 TO 13
1445 FOR K=3 TO 12
1450 IF A(I)=11 THEN PRINT AT J,
K;"O";
1455 IF A(I)=12 THEN PRINT AT J,
K;"█";
1460 IF A(I)>12 THEN PRINT AT J,
K;"█";
1465 IF A(I)=0 THEN PRINT AT J,K
;" ";
1470 IF A(I)=11 THEN LET N=N+1
1475 IF A(I)=12 THEN LET M=M+1
1480 IF A(I)>12 THEN LET D=D+1
1482 LET N(C)=N
1484 LET M(C)=M
1486 LET D(C)=D
1490 LET I=I+1
1500 NEXT K
1510 NEXT J
1515 RETURN
1520 PRINT AT 3,24;C-1;AT 5,15;"
O NORMAL    ";N;AT 6,15;"█ IMMUNE
    ";M;AT 7,15;"█ DISEASED  ";D
1530 INPUT A$
1540 IF A$="" THEN GOTO 1600
1550 IF A$="H" THEN GOTO 2200
1560 IF A$="E" THEN GOTO 1000
1570 IF A$="T" THEN GOTO 1900
1580 IF A$="I" THEN GOTO 10
1590 STOP
1600 REM [illegible]
1610 LET N=0
1620 LET M=0
1630 LET D=0
1640 PRINT AT 5,26;"  ";AT 6,26;
"  ";AT 7,26;"  "
1650 FOR I=11 TO 110
1660 IF A(I)=0 THEN GOTO 1790
1670 LET Y=INT (A(I-10)/10)+INT
(A(I+10)/10)+INT (A(I-1)/10)+INT
 (A(I+1)/10)
1680 IF (A(I)=11 OR A(I)=12) AND
 Y>2 THEN LET A(I)=0
1690 IF A(I)=0 THEN GOTO 1790
1700 IF Y<2 THEN LET R=INT (RND*
100+1)+10
1710 IF A(I)=11 AND A(R)=0 THEN
LET A(R)=11
1720 IF A(I)=12 AND A(R)=0 THEN
LET A(R)=12
1730 IF A(I)>12 AND A(R)=11 THEN
 LET A(R)=13
1740 IF A(I)>12 THEN LET A(I)=A(
I)+1
1750 IF A(I)=16 THEN LET A(I)=0
1790 NEXT I
1800 LET C=C+1
1808 LET O=C
1810 GOSUB 1435
1820 PRINT AT 3,24;C-1;AT 5,26;N
;AT 6,26;M;AT 7,26;D
1830 GOSUB 300
1840 GOTO 1530
1900 REM [illegible]
1910 CLS
1920 PRINT AT 0,0;B$
1930 PRINT AT 1,0;"C   N   I   D
    C   N   I   D"
1940 PRINT AT 18,0;N$
1950 PRINT AT 19,6;"H FOR HISTOG
RAM";AT 20,6;"E FOR NEW EXPERIME
NT"
1951 PRINT AT 21,6;"I FOR INDEX"
1960 FOR J=1 TO 16
1970 PRINT AT J,15;"█";
1980 NEXT J
1990 LET C=2
2000 FOR J=2 TO 16
2010 PRINT AT J,0;C-1;AT J,4;N(C
);AT J,8;M(C);AT J,12;D(C)
2020 LET C=C+1
2030 IF C>O THEN GOTO 2160
2040 NEXT J
2050 FOR J=2 TO 16
2060 PRINT AT J,17;C-1;AT J,21;N
(C);AT J,25;M(C);AT J,29;D(C)
2070 LET C=C+1
2080 IF C>O THEN GOTO 2180
2090 NEXT J
2100 INPUT A$
2110 IF A$="" THEN GOTO 2000
2120 IF A$="H" THEN GOTO 2200
2130 IF A$="E" THEN GOTO 1000
2140 IF A$="I" THEN GOTO 10
2150 STOP
2160 PRINT AT J+1,0;"[illegible]"
2170 GOTO 2100
2180 PRINT AT J+1,16;"[illegible]"
2190 GOTO 2100
2200 REM HISTOGRAM
2210 CLS
```

(listing continued on page 48)



SPREAD OF DISEASE IN A WOODLAND

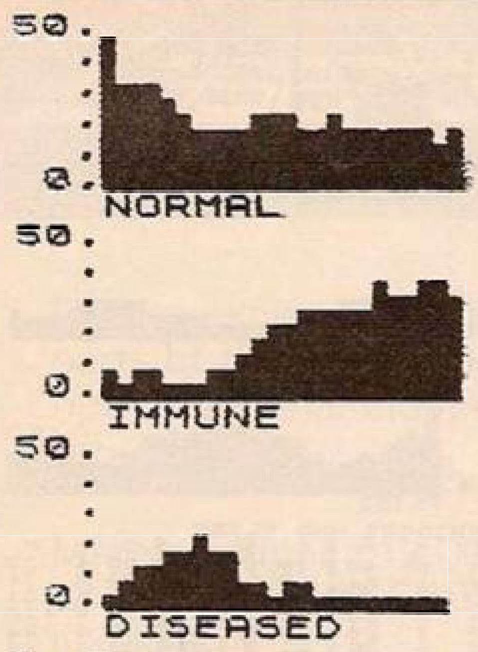


Figure 5.

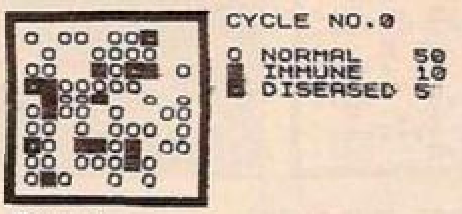


Figure 1.

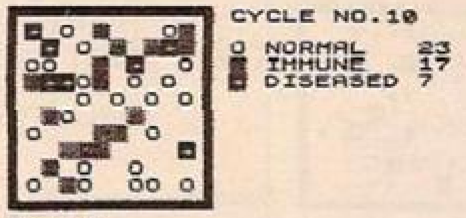


Figure 2.

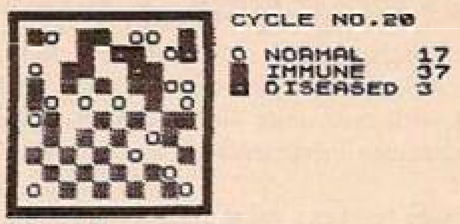


Figure 3.

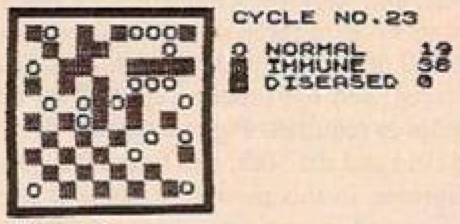


Figure 4.

SPREAD OF DISEASE IN A WOODLAND

C	N	I	D	C	N	I	D
1	35	4	9	16	19	33	3
2	37	7	14	17	22	32	3
3	36	6	14	18	22	39	2
4	30	4	20	19	19	35	3
5	24	5	21	20	17	37	3
6	21	4	23	21	17	42	3
7	20	6	19	22	16	44	2
8	18	9	17	23	19	38	0
9	20	15	11	END			
10	23	17	7				
11	26	23	5				
12	24	25	6				
13	22	25	7				
14	21	29	4				
15	25	30	3				

Figure 6.

histogram — figure 5 — or as a table of counts for pupils to make their own graphs — figure 6.

It is possible to elaborate this program so that the disease is spread only to immediate neighbours, for instance, or to prolong the life-span of diseased trees, and so on.

The second model concerns spiders and flies, and the prey and predator relationship. The basic idea is the same: the program asks for the initial number of flies — a maximum of 50 — and spiders — a maximum of 20 — and these are scattered at random in the 10-by-10 field. This initial field and the counts are displayed — figure 7.

The same kind of interrogation of each cell is then carried out, but the manipulation is different: if a fly is unfortunate enough to be adjacent to a spider — north, south, east or west but not diagonally — then it is eaten. Otherwise, it is moved to another empty cell at random. A fly not adjacent to a spider is allowed to reproduce.

A constraint limits the number of new flies in each generation to half the number of parent flies, that is, a reproduction factor of 1.5, so that if there are 30 flies in one field, there will be 45 in the next.

Another limit ensures that there are not more flies than there are spaces in the matrix for them. All the flies are redistributed randomly, as they would be in life were they flying about.

The spiders, on the other hand, do not move, as they are supposed to be sitting in

(continued on next page)



(continued from previous page)

their webs. Each spider, at the start of its life, is given a store of food, valued at three units, but this is depleted by one unit per cycle, and a spider with zero units dies. However, each fly it consumes increments its food store by one unit.

If a spider reaches a value greater than six, it reproduces, the offspring being set at random in the field, and both it and its parent are given the starting value of three units.

At the end of each cycle the field and counts are displayed, and the process repeated for as many cycles as required. Figures 8 and 9 show the 10th field and the 50th, and figure 9 shows the histograms. In this particular run, starting with 50 flies and five spiders, there has been a cyclic fluctuation in the populations and the peaks are staggered as they would be in nature.

Other starting figures will give different degrees of fluctuation and if there are too few flies or too many spiders at the start, the spiders can actually die out. It is assumed that the flies' food source is inexhaustible.

Although the displayed field is a 10-by-10 matrix, the actual field is 10-by-12. The reason for this is as follows: in the interrogation of, say, the jth cell, we have to look at the adjacent cells, j−10, j+10, j−1 and j+1 — the diagonal cells are not considered.

Now, if we wanted to interrogate cell 4, say, of a 10-by-10 matrix, we should have to look at cell 4−10, which does not exist and would crash the program. Similarly, cell 93+10, say, does not exist; so we have two rows of guard cells — 1 to 10 and 111 to 120 — which are not interrogated and are cleared on each cycle in lines 300 to 350, leaving the interrogated cells as 11 to 110. Note that the left and right sides of the field are, in effect, contiguous, so that the field is really cylindrical. This does not invalidate the models in any way.

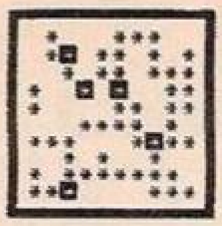


Figure 7.

SPIDERS AND FLIES

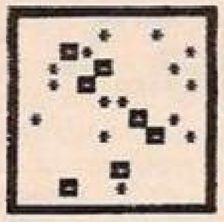


Figure 8.

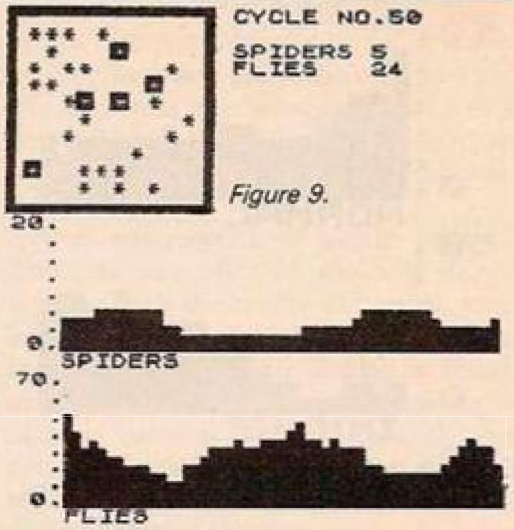


Figure 9.

SPIDERS AND FLIES

C	S	F	C	S	F	C	S	F
1	5	40	16	2	26	31	4	35
2	5	34	17	2	30	32	3	34
3	5	35	18	2	33	33	4	31
4	6	33	19	2	33	34	5	30
5	7	28	20	2	35	35	6	22
6	6	26	21	2	32	36	6	20
7	6	23	22	2	33	37	6	19
8	7	22	23	2	36	38	6	19
9	7	21	24	2	37	39	6	15
10	7	15	25	2	38	40	6	15
11	7	15	26	2	40	41	6	16
12	4	12	27	2	45	42	6	17
13	4	14	28	3	37	43	5	19
14	2	20	29	3	37	44	3	23
15	2	23	30	3	34	45	3	27

Figure 10.

In the woodland program, normal, immune and diseased trees are distinguished by giving the cells values 11, 12 and 13 respectively — lines 1260 to 1420 — and the number of neighbours is determined by the sum of the tens digits in the adjacent cells — line 1760. The various operations on the cells are carried out in lines 1680 to 1790.

In the spiders and flies program, spiders are given an initial value of three — line 3350 — and this is decremented on each cycle by one, and incremented by one for each fly consumed — line 3710. Reproduction of spiders is carried out in lines 3740 to 3760. Reproduction is considered asexual in this model, but a sexual method could be incorporated.

Matrix cells with flies are given a value of 100 — line 3290 — which is a higher value than any spider is likely to reach. Flies' reproduction is carried out at line 3610 where the number of flies is increased by a factor of 1.5. It is interesting to experiment with other reproductive factors.

For both parts of the program an index is provided at the start, lines 40 to 170, and instructions for proceeding are displayed at each stage. Each cycle takes about 15 seconds in fast mode.

(listing continued from page 46)

```
2220 PRINT AT 0,1;"50";AT 7,1;"5
0";AT 14,1;"50"
2230 PRINT AT 5,2;"0";AT 12,2;"0
";AT 19,2;"0"
2240 PRINT AT 21,0;"E FOR NEW EX
PT. I FOR INDEX"
2250 FOR I=0 TO 19
2260 PRINT AT I,3;".";
2270 NEXT I
2280 PRINT AT 6,4;"NORMAL";AT 13
,4;"IMMUNE";AT 20,4;"DISEASED"
2310 PRINT AT 6,3;" ";AT 13,3;"
"
2320 LET X=8
2330 FOR I=1 TO Q
2340 IF N(I)>50 THEN LET N(I)=50
2350 IF M(I)>50 THEN LET M(I)=50
2360 IF D(I)>50 THEN LET D(I)=50
2370 FOR J=32 TO N(I)*9/50+32
2380 PLOT X,J
2390 NEXT J
2400 FOR J=18 TO M(I)*9/50+18
2410 PLOT X,J
2420 NEXT J
2430 FOR J=4 TO D(I)*9/50+4
2440 PLOT X,J
2450 NEXT J
2460 IF N(I)=0 THEN UNPLOT X,32
2470 IF M(I)=0 THEN UNPLOT X,18
2480 IF D(I)=0 THEN UNPLOT X,4
2490 LET X=X+1
2500 NEXT I
2510 INPUT A$
2520 IF A$="E" THEN GOTO 1000
2530 IF A$="I" THEN GOTO 10
2540 IF A$="T" THEN GOTO 1900
2550 STOP
3000 REM [illegible]
3005 CLS
3010 LET B$="SPIDERS AND FLIES"
3020 PRINT TAB 7;B$
3030 PRINT TAB 7;"(PREDATOR AND
PREY)"
3035 PRINT
3040 PRINT "ENTER INITIAL NO. OF
 FLIES      (MAX. 50)";
3050 INPUT F
3060 PRINT F
3065 PRINT
3070 PRINT "ENTER INITIAL NO. OF
 SPIDERS    (MAX. 20)";
3080 INPUT S
3090 PRINT S
3100 PRINT
3110 PRINT N$
3120 INPUT A$
3130 IF A$<>"" THEN STOP
3200 REM [illegible]
3210 CLS
3220 GOSUB 200
3230 DIM F(200)
3240 DIM S(400)
3260 FOR J=1 TO F
3270 LET R=INT (RND*100+1)+10
3280 IF A(R)<>0 THEN GOTO 3270
3290 LET A(R)=100
3300 NEXT J
3320 FOR J=1 TO S
3330 LET R=INT (RND*100+1)+10
3340 IF A(R)<>0 THEN GOTO 3330
3350 LET A(R)=3
3360 NEXT J
3370 LET C=1
3380 GOSUB 3400
3390 GOTO 3540
3400 LET I=11
3410 LET S=0
3420 LET F=0
3430 FOR J=4 TO 13
3440 FOR K=3 TO 12
3450 IF A(I)=0 THEN PRINT AT J,K
;" ";
3455 IF A(I)=0 THEN GOTO 3492
3460 IF A(I)<100 THEN PRINT AT J
,K;"■";
3470 IF A(I)<100 THEN LET S=S+1
3480 IF A(I)=100 THEN PRINT AT J
,K;"*";
3490 IF A(I)=100 THEN LET F=F+1
3492 LET I=I+1
3494 NEXT K
3500 NEXT J
3510 LET F(C)=F
3520 LET S(C)=S
3530 RETURN
3540 PRINT AT 3,24;C-1;AT 5,15;"
SPIDERS ";S;AT 6,15;"FLIES    ";F
3550 INPUT A$
3560 IF A$="" THEN GOTO 3600
3570 IF A$="H" THEN GOTO 4300
3580 IF A$="E" THEN GOTO 3000
3585 IF A$="T" THEN GOTO 4000
3590 IF A$="I" THEN GOTO 10
3595 STOP
3600 REM [illegible]
3630 PRINT AT 5,23;"  ";AT 6,23;
"  "
3640 FOR I=11 TO 110
3650 IF A(I)=100 OR A(I)=0 THEN
GOTO 3770
3660 LET X=INT ((A(I-10)+A(I+10)
+A(I-1)+A(I+1))/100)
3670 IF A(I-10)=100 THEN LET A(I
-10)=0
3680 IF A(I+10)=100 THEN LET A(I
+10)=0
3690 IF A(I-1)=100 THEN LET A(I-
1)=0
3700 IF A(I+1)=100 THEN LET A(I+
1)=0
3710 LET A(I)=A(I)+X-1
3720 LET F=F-X
3730 IF A(I)<6 THEN GOTO 3770
3740 LET A(I)=3
3750 LET R=INT (RND*100+1)+10
3760 LET A(R)=3
3770 NEXT I
3780 FOR I=11 TO 110
3790 IF A(I)=100 THEN LET A(I)=0
3800 NEXT I
3810 LET F=F+INT (F/2)
3820 IF F=0 THEN GOTO 3880
3830 IF F>100-S THEN LET F=100-S
3840 FOR J=1 TO F
3850 LET R=INT (RND*100+1)+10
3860 IF A(R)=0 THEN LET A(R)=100
3870 NEXT J
3880 LET C=C+1
3890 LET Q=C
3900 GOSUB 3400
3910 PRINT AT 3,24;C-1;AT 5,23;S
;AT 6,23;F
3920 GOSUB 300
3930 GOTO 3550
4000 REM [illegible]
4005 CLS
4010 PRINT B$
4020 PRINT "C   S   F    C   S   F
C   S   F"
4030 PRINT AT 18,0;"PRESS NEWLIN
E IF TABLE NOT FULL";AT 19,6;"H
FOR HISTOGRAM";AT 20,6;"E FOR NE
W EXPERIMENT";AT 21,6;"I FOR IND
EX"
4040 FOR I=1 TO 16
4050 PRINT AT I,8;"▌";AT I,18;"▌
"
4060 NEXT I
4070 LET C=2
4075 LET P=0
4080 FOR K=1 TO 3
4090 FOR J=2 TO 16
4100 PRINT AT J,P+0;C-1;AT J,P+3
;S(C);AT J,P+6;F(C)
4110 LET C=C+1
4120 IF C>Q THEN GOTO 4220
4130 NEXT J
4140 LET P=P+10
4150 NEXT K
4160 INPUT A$
4170 IF A$="" THEN GOTO 4075
4180 IF A$="H" THEN GOTO 4300
4190 IF A$="E" THEN GOTO 3000
4200 IF A$="I" THEN GOTO 10
4210 STOP
4220 PRINT AT J+1,P;"[illegible]"
4230 GOTO 4160
4300 REM [illegible]
4310 CLS
4320 PRINT AT 0,0;20;AT 7,1;0;AT
 10,0;70;AT 17,1;0;AT 8,3;"SPIDE
RS";AT 18,3;"FLIES"
4330 PRINT AT 20,0;"PRESS T FOR
TABLE,E FOR NEW EXPT";AT 21,6;"I
 FOR INDEX"
4340 FOR J=0 TO 17
4350 PRINT AT J,2;".";
4360 NEXT J
4400 PRINT AT 9,2;" ";AT 8,2;" "
4410 LET X=6
4420 FOR I=1 TO Q
4430 IF F(I)>70 THEN LET F(I)=70
4440 IF S(I)>20 THEN LET S(I)=20
4450 FOR J=28 TO S(I)*14/20+28
4460 PLOT X,J
4470 NEXT J
4480 FOR J=8 TO F(I)*14/70+8
4490 PLOT X,J
4500 NEXT J
4510 IF S(I)=0 THEN UNPLOT X,28
4520 IF F(I)=0 THEN UNPLOT X,8
4530 LET X=X+1
4540 NEXT I
4550 INPUT A$
4560 IF A$="E" THEN GOTO 3000
4570 IF A$="T" THEN GOTO 4000
4580 IF A$="I" THEN GOTO 10
4590 STOP
```

USER-DEFINED

Mike Berry shows you how to prime those user-defined keys to eliminate some of programming's more laborious tasks.

COMPUTER TERMINALS used by professionals frequently have keys which can be set up by the programmer to generate functions which are used repeatedly. As a professional programmer, I was impressed to find that the BBC Micro provides such a facility.

User-defined keys are the red ones along the top of the keyboard labelled f0 to f9. Program 1's sole purpose in life is to set up the keys to perform useful tasks, leaving you to get on with more interesting problems. Keys are programmed by entering a command of the form

*KEYn

followed by whatever you want the key to produce when you use it, the "n" is the number of the user-defined key. If you want to attach a Return to the end, you simply add the symbol "¦", followed by the letter "M".

*Key0 Auto simply puts the keyword "Auto" on to the next line, where it waits for you to enter the starting line number and/or the increment. Although the default values for these are normally satisfactory, typing errors during program entry make it necessary to Escape from Auto so often that it is best to avoid including the line number and the "¦M" on this key.

Just one touch of *Key1, Run¦M starts your program.

The *Key2 Renumber¦M command allocates new line numbers throughout your program, the defaults being 10 for the first line, and increments of 10 for subsequent lines. Statement numbers appearing in Goto and Gosub branches are cleverly adjusted for you. This facility is very useful as your program develops, and you keep cramming in extra code. It is also spectacularly fast.

Keywords preceded by an asterisk are, technically, commands. The command *Ca't' on key 3 starts the cassette recorder. Your BBC computer will then read through the tape until you tell it to stop, by pressing Escape. While it does this, it checks the accuracy of what it is reading, and puts out messages similar to those you see while a program is being loaded. Thus, you can check that you have saved a program securely, before you lose it from the machine's memory.

*Key4 List¦M is useful for program development. If you like to see your For-Next and Repeat-Until loops indented in the program listing, you could achieve this by altering this statement to

"*KEY4 LISTO 7¦M LIST¦M"

Left untouched, the machine will, in response to a List command, scroll at impressive speed through the whole program listing. The normal way of combatting this is to press the N key simultaneously with the Ctrl key. Thereafter, the machine will be in Page Mode, so only one screen full of program listing will be displayed at one time. To move on to the next page, you hit Shift. The VDU 14 instruction in *Key5 VDU14¦M has exactly the same effect as Ctrl-N. Incidentally, VDU 15 turns the Page Mode off. This user-defined key is particularly handy because Page Mode is turned off every time you press Break or run your program.

Since you can load a program without specifying its name, and it is good practice to keep only one program per side of each cassette, inherent lazines suggests abandoning names and making use of *Key6 Load ""¦M.

When developing graphics programs, you probably find yourself constantly moving from a graphics mode to a program listing. This means that you either get whopping great print, or other unreadable text. So, *Key7 Mode 7¦M puts you straight back into Mode 7, which is the teletext mode you started in, with good clear text.

The FX in *Key 8*FX137, 1¦M/or effects command ia a direct instruction to the operating system. This particular one starts up the cassette recorder. This overcomes an irritating little habit of the BBC Micro to be always



KEYS

Figure 1.

```
 10 REM Initialisation Program
    © Mike Berry 1982
 20 *KEY0 AUTO
 30 *KEY1 RUN¦M
 40 *KEY2 RENUMBER¦M
 50 *KEY3 *CAT¦M
 60 *KEY4 LIST¦M
 70 *KEY5 VDU14¦M
 80 *KEY6 LOAD""¦M
 90 *KEY7 MODE7¦M
100 *KEY8 *FX 137,1¦M
110 *KEY9 *FX 137,0¦M
120 *KEY10 OLD¦M
130 PRINT "Initialisation complete"
140 END
```

telling the cassette recorder to be off when you want it to be on, for example, when you want to rewind the tape after loading or saving a program.

*Key9, *FX 137,0¦M turns the cassette motor off. Use it after you have rewound your tape.

*Key10 Old¦M is the break key. After you use the break key to escape from nasty program error situations, you find that you have to re-activate your program by typing in Old. After your user-defined keys have been initialised as I suggest, the break key will produce the effect of Old as well as its usual function.

The BBC Micro has a very useful plastic strip above the keys, under which you can slide a strip of paper to label the user-defined keys. You can prepare the machine for a programming session with CH."" and Return. The initialisation program then loads and automatically runs. This only takes a few seconds, after which time the machine is set up in a thoroughly professional manner for the real business of programming.

You may have blocks of program code which crop up repeatedly in your program. It is a simple matter to attach all the common code to a user-defined key.

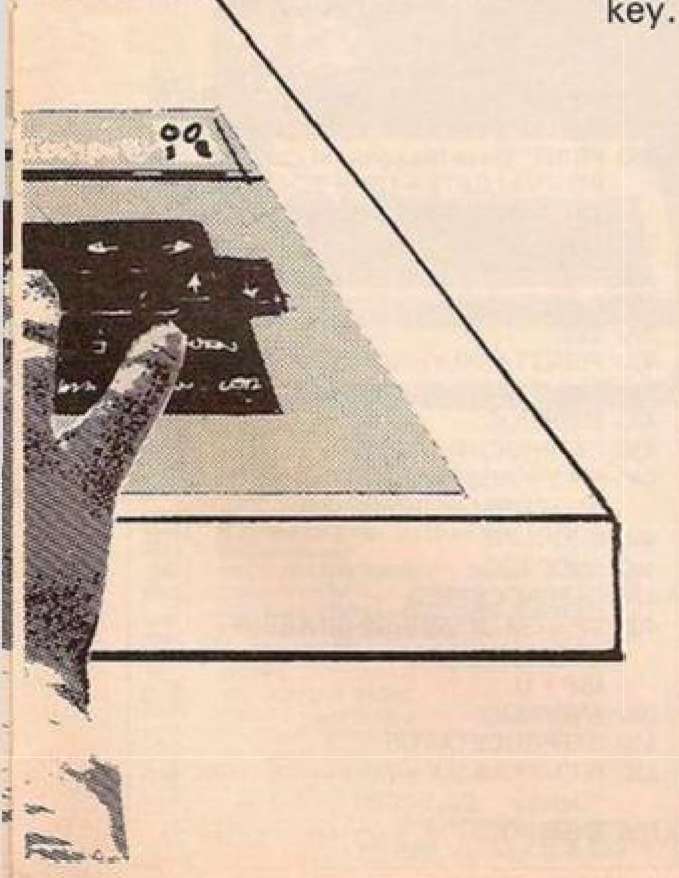
Another possible use is to store under each key one of your favourite Sound routines. The sound facilities of the BBC Micro are very sophisticated, but making the best use of them does entail difficult coding of Envelope and Sound statements. It makes sense to keep these carefully contrived statements for your best sound effects, to be used in successive programs. Unfortunately, it is difficult to remember what they sound like. By storing them in a program similar to the one in program 1, you can put your routines on to the user-defined keys, and they try them until you find the most suitable for your purpose.

You could also use the user-defined keys for input during execution of your program. This could even out wear on the popular keys used for controlling movements during games, and could make it possible to input lengthy replies with minimum effort, for example in Adventure games.

What you store under a user-defined key does not have to be just one command or statement. You can store a multi-statement line, with semicolons, or string together a series of commands, each of which ends with a "¦M". You can even program one user-defined key to define another user-defined key. If you reach the limit of how much you can store under one key, the machine will complain noisily. ■

TELETEXT MODE

The BBC Micro's teletext mode — a standard feature on every machine — presents many useful features if only the beginner can fathom its inner workings. John Thomas offers the key.



SOME VERY UNUSUAL effects can be obtained with the BBC's teletext character set. The set consists of control codes, 0-31, as in the other display modes — followed by an ASCII character set with lower case, a set of screen control codes, and a repeat of the ASCII set.

A list of the interesting screen control codes and their functions appears in table 1.

Eight colours including black or white text or block graphics as well as flashing and double-height characters are possible by prefixing any characters printed, with one of the special codes. The codes act for one line only — until the next new line occurs — and are printed as spaces. To print characters of a specified colour, say, red, you must

PRINT CHR$ 129; X$

where X$ represents any string. Anything printed in this line will appear in red but the effect does not continue on to the next line.

The block-graphics codes produce the standard teletext symbols found on the RML 380-Z and other computers. A list of the graphics, their codes and the characters they normally correspond to follow in table 2.

(continued on next page)

Table 2. Test program.

```
 10 REM" Press space bar to continue
 20 ONERRORGOTO360
 30 MODE 7
 40 PROCPOKE
 50 PROCTELE
 60 VDUL4:END
 70 DEF PROCTELE
 80 C=32
 90 REPEAT
100   IF(C-32)MOD24=0 PRINT"Graphic",
      "ASCII code", "Character"
110   CL=(C-32)MOD6
120   VDU(129+CL),157,154,151,156,C,
      (129+CL),157,135:PRINTC;SPC(10);
      CHR$C
130   REM" Test for space bar.
140   REPEAT UNTIL INKEY$8=" "
150   C=C+1
160   Until C 255
170 ENDPROC
180 REM" Colour REMs
190 DEPROCPEEK
200 P+PAGE
210 T=TOP
220 FORA= P TO T
230   PRINTA-PAGE,?A,CHR$(ABS((?A
      31ANDA 127(''?A))
240   REPEAT UNTIL INKEY$8=" "
250   NEXT
260 ENDPROC
270 DEFPROCPOKE
280 FORN=1 to 3
290   READA
300   A=A+PAGE
310   ?A=129:?(A+1)=157:?(A+2=131
320   NEXT
330 DATA6,240,304
340 ENDPROC
350 REPORT:PRINT" at line ":ERL:VDU14:
    END
```

This program lists all printable characters and their equivalent graphics. It is listed in List07 so do not insert spaces except where the " " symbol occurs. As the program uses the BBC Poke it must be entered very carefully. ProcPeek was used in development and lists the contents of the memory which the program occupies with its address relative to Page. ProcPoke demonstrates coloured Rems. ProcPeek and ProcPoke may be left out altogether — the program will still run on.

(continued from previous page)

Flashing characters are a relatively simple matter. Chr$ 136; is printed before the character required to flash. This code will make anything printed after it on the same line flash, behaving similarly to the other codes, and does not affect the following line. However, another ASCII code, Chr$ 137 will cancel the flash.

Double-height characters are caused by code 141 and may be cancelled by code 140. In order to produce a full word in double-heights, it must be printed twice. For example, to print "Hello" in double-height-

```
PRINT CHR$ 141; "Hello"; CHR$ 141; "Hello"
```

must be used.

Code 154 only acts on block graphics and it produces distinct pixels instead of the normal contiguous pixels.

Chr$ 158 has even more esoteric effects. This screen control code does not appear on the screen but causes the last graphics symbol printed to be repeated in the same character cell as Chr$ 158.

Either VDU or Chr$ may be used to produce the teletext effects and there is no real difference in memory terms between the two except when multiple effects are required. For example

```
PRINT CHR$ 130; CHR$ 136; CHR$ 141;
"Colour"; CHR$BC; CHR$ 136; CHR$
141; "Colour"
```

will produce the word "Colour" in double-height, flashing green. The following routine uses four bytes less — VDU and Chr$ are tokenised and use only one byte each — and is more concise, involving less typing.

```
VDU 130, 136, 141; PRINT "Colour";
VDU 130, 136, 141: PRINT "Colour"
```

Different background and foreground colours are also possible.

Printing a colour code followed by Chr$ 157 followed by another colour code will produce a line with the first colour as the background and any characters in the foreground colour

```
VDU 129, 157, 131
```

will turn anything in a following Print statement into yellow on a red background.

A further property of the teletext mode is that, since any character on the screen may be copied to the lowest line by the editing cursor, all the features of the graphics may act actually within listings.

Suppose you wanted a Remark with red, double-height, flashing characters on a light-blue background. By using

```
VDU 134, 157, 129, 141, 136
```

as a direct command, five characters are printed on the screen below the VDU command and above the next > symbol. These characters cannot be seen but can be copied into the Rem statement by moving the editing cursor to the line below VDU and using the copy key. Note that the open quote must be used since some of the special characters are recognised by the Basic as tokens and will be converted into full keywords unless the quote is used. No closing quote is required except in Print statements where this technique may be used to show in the listing what will actually appear on the screen instead of showing a list of meaningless numbers and characters.

Teletext mode uses only 1K of memory and has a resolution of 80 by 75.

```
VDU 129, 157, 131
```

will turn anything in a following Print statement into yellow on a red background, and all eight colours can be produced, flashing and in double-height. On the model A with only 3K of user memory in the higher graphics modes — 10K for the screen and 3.5K for the machine operating system — this is especially significant. ■

Table 1. Useful teletext codes.

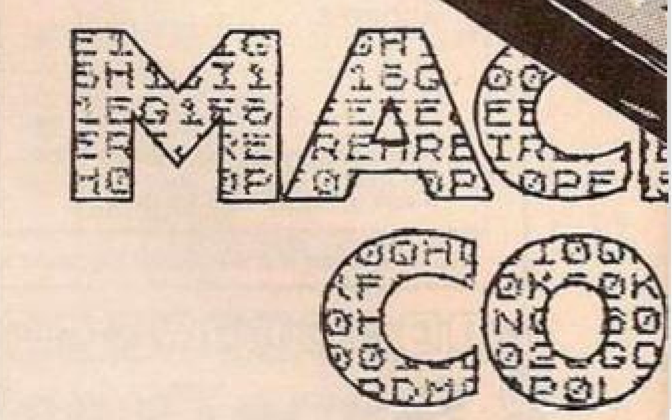
Code	Effect	
127	Delete	
128	space	
129	red text	Change colour — effective for one line only — if used before Chr$157 will affect background otherwise will affect foreground
130	green text	
131	yellow text	
132	blue text	
133	magenta text	
134	light-blue text	
135	white text (Copy)	
136	turns flash on (left cursor key)	Codes produced by cursor keys and Copy key after *FX4,1
137	cancels flash (right cursor key)	
138	(down cursor key)	
139	(up cursor key)	
140	cancels double-height	
141	turns on double-height	
142		
143		
144		
145	red graphics	
146	green graphics	
147	yellow graphics	
148	blue graphics	
149	magenta graphics	
150	light-blue graphics	
151	white graphics	
152	rubs out following text on one line	
153	cancels pixel graphics	
154	turns on pixel graphics	
155		
156	removes background — opposite of Chr$ 157	
157	fills line white/colour	
158	repeats graphics when spaces/screen commands occur	
159		

Table 3. Demonstration program.

```
1 REM (C) John Thomas 1982. Teletext
  display demonstration
10 *FX4,1
11 REM cursor and COPY keys produce
   ASCII codes
20 *FX11,1
21 REM Turn off auto repeat
25 *KEY10OLD:M
26 REM Programs BREAK key
30 MODE 7
40 ON ERROR GOTO 60
50 Y=12:SP=11
60 PROCCOL
70 INPUTLINE ' '"Enter message: "MS$
80 IFMS$="" MS$=" Moving display
   teletext demonstration. Copyright J T
   1982.
Cursor keys may be used to change the
speed of motion and to alter the display's
altitude. Press ""C"" to alter colours."
90 PROCLINE
100 MS$=STRING$(35," ")+MS$
    +STRING$(35," ")
110 DS$=MS$
120 REPEAT
130 PRINTTAB(3,Y);CHR$141;LEFT$
    (DS$,35)
140 PRINTTAB(3,Y+1);CHR$141;LEFT$
    (DS$,35)
150 DS$=MID$(DS$,2)
160 I$=INKEY$SP
170 IFI$="C" PROCCOL:PROCLINE
180 IFI$=CHR$139ORI$=CHR$138
    PROCHEIGHT
190 IFI$=CHR$136OR3$=CHR$137
    PROCSPEED
200 PROCSTATUS
210 UNTILEND$=1
220 GOTO 110
230 DEFPROCCOL
240 *FX11,50
250 CLS
260 PRINT"Colours available are:"
270 PRINT'TAB'(10);"(1) Red"
280 PRINT'TAB)10);"(2) Green"
290 PRINT'TAB(19);"(3) Yellow"
300 PRINT'TAB(19);"(4) Blue"
310 PRINT'TAB(10);"(5) Magenta"
320 PRINT'TAB(10);"(6) Cyan"
330 PRINT'TAB(10);"(7) White"
335 PRINT'TAB(10);"(8) Flashing fore-
    ground"
340 PRINT'"Press foreground colour . . .";:
    FC=VALGET$+128:IFFC<129ORFC>
    135 GOTO340 ELSE PRINT FC-128
350 PRINT"Press background colour . . .";:
    BC=VALGET$+128:IFBC<129ORBC>
    136 GOTO350 ELSE PRINT BC-128
360 *FX11,0
370 ENDPROC
380 DEFPROCLINE
390 CLS
400 PRINTTAB(0,Y);:VDUBC,157,FC
410 PRINTTAB(0,Y+1);:VDUBC,157,FC
420 ENDPROC
430 DEFPROCHEIGHT
440 Y=Y+ABS(I$=CHR$139)*VPOS 2)+
    (I$=CHR$138)*(VPOS 23)
450 PROCLINE
460 ENDPROC
470 DEFPROCSPEED
480 SP=(SP-1)*ABS(SP 0)*ABS(I$=
    CHR$136)+ABS(I$=CHR$137)*
    (SP+1)
500 ENDPROC
510 DEFPROCSTATUS
520 PRINTTAB(0,Y+2);"Y=";";Y;SPC(5);
    "Delay=";SP;SPC(5)
530 ENDPROC
```

Loathe to leave the safety and comfort of Sinclair Basic, the ZX-81 user all too often misses out on the simplicity, speed and economy of machine-code programming. With the first part of this new series, Kathleen Peel aims to coax the timorous ZX owner out of his Basic refuge by demonstrating just how uncomplicated machine-code can be. She clears up the normal confusions by giving the Basic equivalent of every piece of code she discusses.





SPEED A

Table 1.

Code	Mnemonic	Basic equivalent
6	LD B N	LET B = N
14	LD C N	LET C = N
22	LD D N	LET D = N
30	LD E N	LET E = N
38	LD H N	LET H = N
46	LD L N	LET L = N
1	LD BC NN	LET BC = NN
17	LD DE NN	LET DE = NN
33	LD HL NN	LET HL = NN
4	INC B	LET B = B+1*
12	INC C	LET C = C+1*
20	INC D	LET D = D+1*
28	INC E	LET E = E+1*
36	INC H	LET H = H+1*
44	INC L	LET L = L+1*
3	INC BC	LET BC = BC+1
19	INC DE	LET DE = DE+1
35	INC HL	LET HL = HL+1
5	DEC B	LET B = B-1*
13	DEC C	LET C = C-1*
21	DEC D	LET D = D-1*
29	DEC E	LET E = E-1*
37	DEC H	LET H = H-1*
45	DEC L	LET L = L-1*
11	DEC BC	LET BC = BC-1
27	DEC DE	LET DE = DE-1
43	DEC HL	LET HL = HL-1
9	ADD HL BC	LET HL = HL+BC
25	ADD HL DE	LET HL = HL+DE
128	ADD A B	LET A = A+B*
129	ADD A C	LET A = A+C*
130	ADD A D	LET A = A+D*
131	ADD A E	LET A = A+E*
132	ADD A H	LET A = A+H*
133	ADD A L	LET A = A+L*
144	SUB A B	LET A = A-B*
145	SUB A C	LET A = A-C*
146	SUB A D	LET A = A-D*
147	SUB A E	LET A = A-E*
148	SUB A H	LET A = A-H*
149	SUB A L	LET A = A-L*
120	LD A B	LET A = B
121	LD A C	LET A = C
122	LD A D	LET A = D
123	LD A E	LET A = E
124	LD A H	LET A = H
125	LD A L	LET A = L
71	LD B A	LET B = A
79	LD C A	LET C = A
87	LD D A	LET D = A
95	LD E A	LET E = A
103	LD H A	LET H = A
111	LD L A	LET L = A
62	LD A N	LET A = N
60	INC A	LET A = A+1*
61	DEC A	LET A = A-1*
112	LD (HL) B	POKE HL, B
113	LD (HL) C	POKE HL, C
114	LD (HL) D	POKE HL, D
115	LD (HL) E	POKE HL, E
116	LD (HL) H	POKE HL, H
117	LD (HL) L	POKE HL, L
119	LD (HL) A	POKE HL, A
54	LD (HL) N	POKE HL, N
70	LD B (HL)	PEEK HL, B
78	LD C (HL)	PEEK HL, C
86	LD D (HL)	PEEK HL, D
94	LD E (HL)	PEEK HL, E
102	LD H (HL)	PEEK HL, H
110	LD L (HL)	PEEK HL, L
126	LD A (HL)	PEEK HL, A
194	JP NZ NN	
195	JP NN	
202	JP Z NN	
201	RETURN	

As you acquire programming skills, you become aware of the limited speed and profligate use of memory in Basic. Real progress can be achieved by the use of machine code.

The sub-set of 14 commands which I define in this article will enable you to write small machine-code routines. Subsequent articles will expand the sub-set, gradually presenting a more exact picture of the Z-80 processor. Table 1 gives the mnemonics and Basic equivalent.

You can buy a piece of software called an assembler which takes the mnemonic instructions, which you can understand, and creates the machine code, which initially you will not understand. So effectively, it is a middle language between what the machine recognises and what the human recognises.

Start from the premise that the Z-80 processor has six variables and they are called B, C, D, E, H and L. These variables can only hold a number and that number has to be within the range 0 to 255, codes 6, 14, 22, 30, 38, 46. The variables can be grouped as pairs BC, DE and HL thus enabling them to hold a larger number, 0 to 65,535, codes 1, 17, 33. The variables and pairs of variables can be increased, codes 4, 12, 20, 28, 36, 44, 3, 19, 35, and decreased, codes 5, 13, 21, 29, 37, 45, 11, 27, 43, by one. You can also add to HL either BC, code 9, or DE, code 25.

If you wish to load a number into variable B, the number that follows the code 6, ld B N, is the number to be loaded into B. Similarly with code 17, ld DE NN, the two numbers following code 17 are the numbers to be loaded into the variable DE. N represents a single number; NN two numbers. If either value is zero it must still be included. If the processor expects two numbers, that is what you must give it. For example:

Basic	Mnemonic	Machine code
LET DE=16514	LD DE NN	17 130 64
LET BC=17152	LD BC NN	1 0 67

Notice that I have equated

16514 = 130 64

and 17152 = 0 67

In NN code the second number is always multiplied by 256 to get its value.

16514 = 130 + 64*256

17152 = 0 + 67*256

Somewhere inside the processor is another variable, A for accumulator. It is the only variable which can be added to, codes 128 to 133, or subtracted from, codes 144 to 149, one of the other variables. We can also put the contents of any one of the variables into A, codes 120 to 125, or put the contents of A into another variable, codes 71, 79, 87, 95, 103, 111. A can be made to equal any number between 0 and 255, code 62, and lastly A can be increased, code 60, or decreased, code 61, by one.

The last variable F, flag, will be defined by the following relationship. I hope you have noticed an asterisk by some of the codes. This indicates that after this operation a test is performed to see if 0 has occurred as a result of the operation.

Basic	Mnemonic	Machine code
LET B=B-1	DEC B	5

Variable F is adjusted on completion of this operation as follows:

Table 2.

Mnemonic	Machine code	Address	
JP NN	195	130 64	The examples all
JP Z NN	202	130 64	jump to Address 16514
JP NZ NN	194	130 64	(130 + 64*256 — remember?)



Address	Machine code	Mnemonic	Basic
16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL = HL + 1
16519	126	LD A (HL)	4 LET A = PEEK HL
16520	128	ADD A B	5 LET A = A + B
16521	79	LD C A	6 LET C = A
16522	6 0	LD B N	7 LET B = 0
16524	201	RET	8 PRINT C

Add two numbers

Program 2.

16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL = HL + 1
16519	126	LD A (HL)	4 LET A = PEEK HL
16520	144	SUB A B	5 LET A = A - B
16521	79	LD C A	6 LET C = A
16522	6 0	LD B N	7 LET B = 0
16524	201	RET	8 PRINT C

Subtract two numbers

Program 3.

16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL =HL + 1
16519	78	LD C (HL)	4 LET C = PEEK HL
16520	62 0	LD A N	5 LET A = 0
16522	129	ADD A C	6 LET A = A + C
16523	5	DEC B	7 LET B = B-1
16524	194 138 64	JP NZ NN	8 IF B < > 0 THEN GOTO 6
16527	79	LD C A	9 LET C = A
16528	6 0	LD B N	10 LET B = 0
16530	201	RET	11 PRINT C

Multiply two numbers

Program 4.

ND MEMORY ECONOMY

```
   1 REM 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   2 REM ▒
 200 CLS
 250 LET C=USR 16514
 300 STOP
 800 FAST
 801 FOR K=16514 TO 16664
 810 SCROLL
 820 INPUT J
 830 POKE K,J
 840 PRINT AT 7,0;K;TAB 8;J
 850 NEXT K
```

```
   1 REM 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
 200 CLS
 210 SLOW
 220 FOR K=2 TO 7
 230 PRINT AT K,8;"*"
 240 NEXT K
 250 LET C=USR 16514
 300 STOP
 800 FAST
 801 FOR K=16514 TO 16664
 810 SCROLL
 820 INPUT J
 830 POKE K,J
 840 PRINT AT 7,0;K;TAB 8;J
 850 NEXT K
```

Program 1, above, and right, program 1a.

If B is equal to 0 let variable F = Z for zero,
if B is not equal to 0 let variable F = NZ for non-zero.

Variable F is only altered by those operations marked with the asterisk. Machine code does not have line numbers, so there is no equivalent to Goto a line number as in a Basic. Your Z-80 processor can jump to any place in memory, called an "address". When you start to load the example machine-code programs in your ZX-81, you will see the numbers of the code that you are typing in. Scroll up the screen. Next to the code number is a five-digit number, the address of your typed-in code. It starts at 16514 and increases by one every time you enter in a new piece of code.

You can jump to any address if the F variable equals Z or you can jump to an address if the F variable equals NZ. That is, was the last test a zero or non-zero?

The form of these commands is in table 2. One further piece of the variable jigsaw is required to enable you to write machine-code programs and that is an understanding of the difference between direct and indirect statements.

A direct statement with a pair of variables would be: load variable with a number, normally an address. An indirect statement with a

(continued on next page)

(continued from previous page)

pair of variables would be: put into an address given by the pair of variables HL a number, code 54, or any single variable, codes 112 to 117, 119 or: put into a single variable the contents of an address given by the pair of variables HL, codes 70, 78, 86, 94, 102, 110. The indirect statement is necessary to put something into memory, Poke, to be be able to look inside the display file to see if anything is there, Peek, and to get at the beginning of the display file so that we can Print to the screen for the creation of playing boards or whatever.

The last and most important command is Return, 201. With a machine-code program, if this instruction is omitted, it will invariably lead to what is known as a system crash; keys become inoperative — the display disappears. You will have to remove the power and switch the machine on again to regain control in the process losing all your program. The golden rule is always Save the program before running any machine code for the first time.

It is far easier to recover from tape than to start typing all over again. The recovered program can then be checked for errors and corrected before being rerun.

Remove memory expansions, then enter program 1. Type Print Peek 16670, Peek 16671 and check that both answers are 8. We are going to enter our variables in Rem 2 and machine code in Rem 1, so it is important that we get the length of Rem 1 exactly right. If you did not get two eights, re-enter Rem 1.

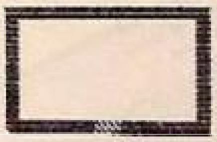
Poke 16510, 0

This stops you from editing the first Rem. Enter program 2 by:

Run 800

When the inverse L appears, type:

```
   1 REM 5£RND?7?5▀ ;????0▄70▄70
▄70▄70▄70▄70▄70▄70▄ )▒ ;Q█ ;Q█ ;Q█ ;
Q█ ;Q▀ ????;Q █;Q █;Q █;Q █;Q ▀70▀70▀70
▀70▒70▀70▀70▀TAN 01234567890123 4
5678901234567890123456789012345 6
7890
 200 CLS
 210 SLOW
 220 FOR K=2 TO 7
 230 PRINT AT K,8;"*"
 240 NEXT K
 250 LET C=USR 16514
 300 STOP
 800 FAST
 801 FOR K=16514 TO 16664
 810 SCROLL
 820 INPUT J
 830 POKE K,J
 840 PRINT AT 7,0;K;TAB 8;J
 850 NEXT K
```



Program 5 and a sample board display.

33/30/65/70/35/126/128/79/6/0/201/R/

Where / stands for Newline. R Newline will cause an exit from the machine-code loader. Look at the machine code of program 2 and the above data entry to see how machine code is entered to a Rem statement. Then type:

RUN

This will produce a number which is the addition of the character codes in Rem 2.

Try editing Rem 2 and put in different characters. Enter program 3 using the same technique. Run 800 and type in the machine code. This program subtracts the first variable of Rem 2 from the second variable.

For both cases only positive answers between 0 and 255 will be correct, again try changing the variables in Rem 2 and see the effect. Enter program 4.

This multiplies the two character codes in Rem 2 together, again only positive answers between 0 and 255 will be correct. The answer is held in the single variable C. Modify program 1 to program 1a. Now let us enter program 5.

It is necessary to create a display file with a Basic program before Poking alternative characters into it with a machine-code routine.

Remember when stepping from one line to another — all lines, even empty ones end with the Newline character, page 172 Sinclair manual, and the Print At starts at column 0, page 123 Sinclair manual.

Program 5 creates a board to demonstrate the difference in speed between machine code and Basic. You can just see the asterisks being printed by the Basic program on the screen, the machine-code board is almost instantaneous. Try putting in a delay and loop in Basic to demonstrate this. Also try different patterns on the screen by varying parts of the machine code. If you have managed to get this far the worst is over. ■

Program 5.

Address	Machine code	Mnemonic	Basic
16514	33 12 64	LD HL NN	LET HL = 16396
	94	LD E (HL)	LET E = PEEK HL
	35	INC HL	LET HL = HL+1
	86	LD D (HL)	LET D = PEEK HL
	33 3 0	LD HL NN	LET HL = 3
	25	ADD HL DE	LET HL = HL+DE
	125	LD A L	LET A = L Save start
	79	LD C A	LET C = A position
	124	LD A H	LET A = H
	71	LD B A	LET B = A
16528	54 135	LD (HL) N	POKE HL, 135 Line across
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 131	LD (HL) N	POKE HL, 131
	35	INC HL	LET HL = HL+1
	54 4	LD (HL) N	POKE HL, 4
16555	17 10 0	LD DE NN	LET DE = 10 Right-hand
	25	ADD HL DE	LET HL = HL+DE line down
	54 5	LD (HL) N	POKE HL, 5
	25	ADD HL DE	LET HL = HL+DE
	54 5	LD (HL) N	POKE HL, 5
	25	ADD HL DE	LET HL = HL+DE

Address	Machine code	Mnemonic	Basic
	54 5	LD (HL) N	POKE HL, 5
	25	ADD HL DE	LET HL = HL+DE
	54 5	LD (HL) N	POKE HL, 5
	25	ADD HL DE	LET HL = HL+DE
	54 1	LD (HL) N	POKE HL, 1
16572	121	LD A C	LET A = C Get start
	111	LD L A	LET L = A position
	120	LD A B	LET A = B
	103	LD H A	LET H = A
	25	ADD HL DE	LET HL = HL+DE Left-hand
	54 133	LD (HL) N	POKE HL, 133 line down
	25	ADD HL DE	LET HL = HL+DE
	54 133	LD (HL) N	POKE HL, 133
	25	ADD HL DE	LET HL = HL+DE
	54 133	LD (HL) N	POKE HL, 133
	25	ADD HL DE	LET HL = HL+DE
	54 133	LD (HL) N	POKE HL, 133
	25	ADD HL DE	LET HL = HL+DE
	54 2	LD (HL) N	POKE HL, 2
16591	35	INC HL	LET HL = HL+1 Bottom
	54 3	LD (HL) N	POKE HL, 3 line across
	35	INC HL	LET HL = HL+1
	54 3	LD (HL) N	POKE HL, 3
	35	INC HL	LET HL = HL+1
	54 3	LD (HL) N	POKE HL, 3
	35	INC HL	LET HL = HL+1
	54 10	LD (HL) N	POKE HL, 10
	35	INC HL	LET HL = HL+1
	54 3	LD (HL) N	POKE HL, 3
	35	INC HL	LET HL = HL+1
	54 3	LD (HL) N	POKE HL, 3
	35	INC HL	LET HL = HL+1
	54 3	LD (HL) N	POKE HL, 3
	201	RET	

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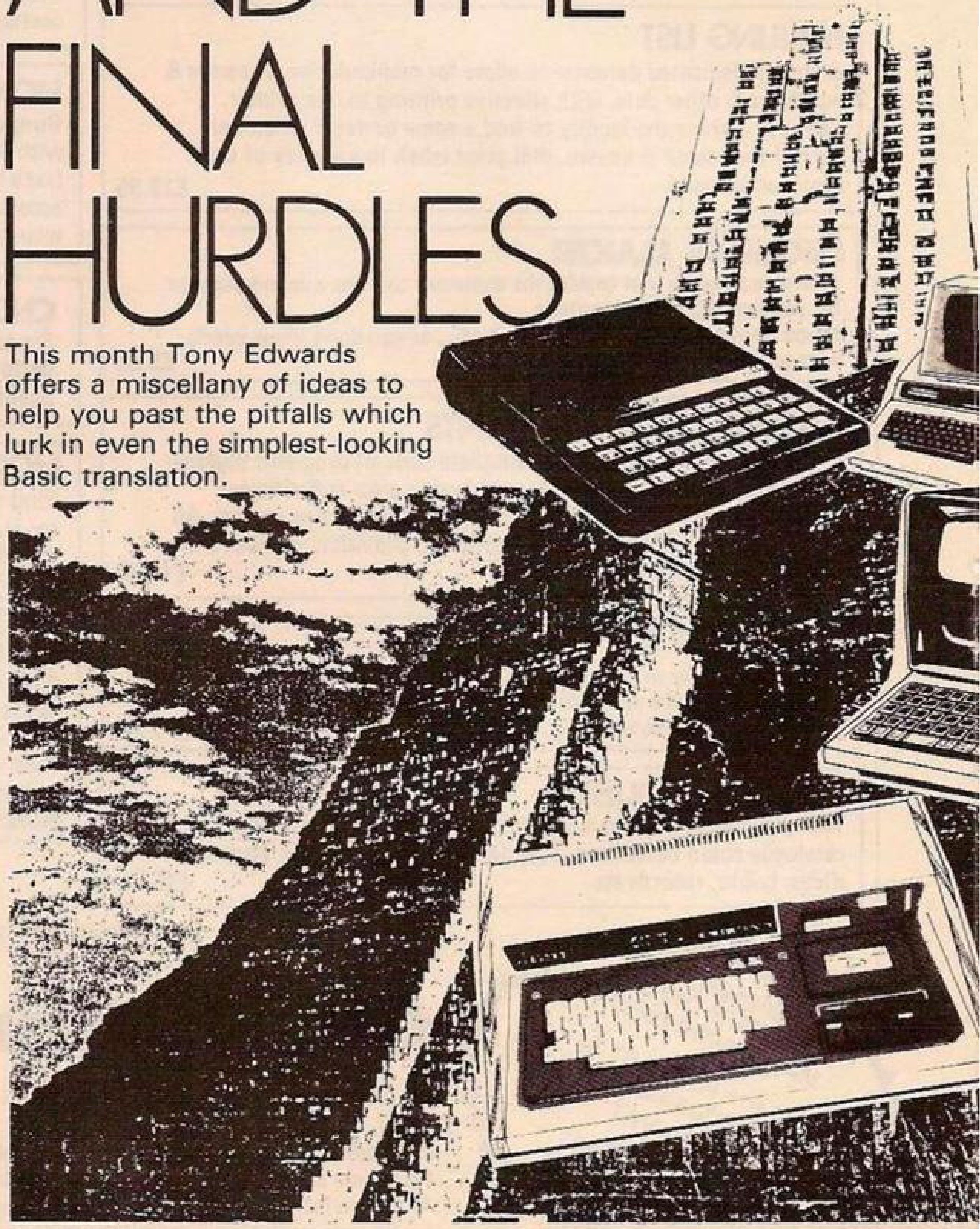
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BASIC TRANSLATION AND THE FINAL HURDLES

This month Tony Edwards offers a miscellany of ideas to help you past the pitfalls which lurk in even the simplest-looking Basic translation.



IT IS USUALLY possible to program efficiently without recourse to logical arithmetic and many programmers are happy to leave it that way. Unfortunately, if you are in the translation business and the original programmer has used logical arithmetic you are obliged to follow suit. This may leave you in an area of your Basic with which you are not familiar and with a machine that insists on being illogical. So let us look at some possible problems.

The logic of the Pet, TRS-80 and Genie is standard with the logical values being integers of -1 for true and 0 for false, but the Apple uses 1 for true and 0 for false. This would seem to be no more than an inconvenience but unfortunately there is a more subtle difference in the way machines deal with individual bits. The line

```
10 IF (X<7) AND (Z< >7) THEN 100
```

will work on most machines and is in fact a very powerful programming tool. Yet if that works, what about the following line?

```
20 IF PEEK (59410) AND 4 THEN 2000
```

It works on a Pet — to see if the space bar has been pressed — but an equivalent line

```
30 A = PEEK (49152) AND 128 THEN 2000
```

on an Apple will not extract a bit from an I/O port. This is because on the TRS-80, Genie and Pet the logical operators And, Or, and Not operate on individual bits, but on the Apple they do not. Consequently line 30 always returns a value of A=1 regardless of the actual value in location 49152. On the Apple

```
A=X AND Y
```

is interpreted as

```
A=(X< >0) AND (Y< >0)
```

Confused? Program 1 is a test program to use on your computer to see how it handles logical arithmetic. Use this program to see how your machine reacts using various line 60s.

```
10 PRINT " 'AND' BINARY LOGIC TEST"
20 PRINT "ENTER VALUE OF X"
30 INPUT X
40 PRINT "ENTER VALUE OF Y"
50 INPUT Y
60 A=X AND Y
70 PRINT "THE LOGICAL 'AND' VALUE
   OF";X; "AND";Y; "IS";A
80 GO TO 10
```

Program 1. Binary logic test.

The logical operators on Sinclair machines are different again. On the ZX-80 true is -1 and false is 0, but on the ZX-81 true is 1 and false is 0. The rules for logical arithmetic on these machines are quite different and you are referred to table 1.

Sinclair owners will know that their version of logical arithmetic lacks a Not function. They cannot use the line

```
10 IF NOT X=10 THEN GO TO 100
```

but it can easily be mimicked with

```
10 IF X-10 THEN GO TO 100
```

which, on a Sinclair, does the job required.

Most games include an element of chance and this is provided by the computer's random-number generator. The first sign of such use often appears at the start of a program when the seed of the generator is reset to ensure a new series of random numbers. The statement used will be Randomise, Random, Rand or Ran. The Pet and Apple set the seed with RND(-X). Your instruction book will tell you how to reset the seed value on your machine.

Having set this, the computer will call for a random number, when it needs one, with RND. RND is almost universal, but the results returned are not and could cause some difficulty in translation. When a program requires a random number, there is a range into which it must fall and different machines handle these ranges differently. For a translation key, see table 2.

If your machine does not have a random function, you must create one and use it as a subroutine. There are a number of complex random-number algorithms but usually a simple one is adequate for games programs. My suggestion is program 2, which returns a pseudo-random number between 0 and 1 as R.

Cursor-control characters are the bane of a translator's life. They sit in other people's

Random number	Pet	Apple	TRS-80 or Genie	ZX-81
0<x<1	RND(1)	RND(1)	RND(0)	RND
0<x<N	N*RND(1)	N*RND(1)	RND(N)	N*RND
A<x<B	A+(B-A)*RND(1)	A+(B-A)*RND(1)	A+RND(B-A)	A+(B-A)*RND

Table 2.

programs, Chr$, and are completely opaque. They cause the computer to do strange things depending on the code in parenthesis behind them — but to the uninitiated there is no way of breaking the code. Codes 32 to 126, except on Sinclair machines, are usually standard ASCII codes which were dealt with last month and codes above 126 are usually graphics symbols — also dealt with last month.

The exceptions are the Genie and TRS-80 where codes above 191 are space-compression codes which cause a number of spaces to be printed, the number of spaces being found by the formula

number = code -192

These are useful in formatting or in erasing characters no longer wanted on the screen.

The codes which cause most trouble are those which move the cursor about and clear parts of the screen. These are covered by the translation key in table 3. An exception is the TRS80's Chr$(23) which causes characters printed to become double-sized. The Apple cursor controls are seldom used in programs as they must be preceded by the escape character, Chr$(27).

Both games and business programs use extensive screen-formatting controls to produce a neat apearance. The Chr$(X) controls and space-compression characters mentioned are part of this formatting but another essential part is the Print At, or Print @ statement. These and similar statements cause a character or string of characters to be printed at a particular position on the screen.

Sinclair machines identify the screen position with two co-ordinates so that

PRINT AT 3, 7, "#"

prints a hash at row 3 of column 7. The TRS-80 and Genie identify 1,024 screen positions so, as the screen is 64 characters wide, the same effect is produced by

PRINT @ 3*64 + 7, "#"

Apple owners do not have this facility but do not need it as they can use

VTAB3:HTAB7:PRINT "#"

to produce the same effect. VTab tabulates vertically and HTab tabulates horizontally.

At this stage readers who own Pets will be wondering what they can do as their machines do not have this feature. They can use a mixture of cursor controls and spaces to produce the same effect. For example,

PRINT CHR$(19), CHR$(17), CHR$(17), CHR$(17),"#"

but this is not very elegent so I offer program 3 which provides Pet owners with a Print @ facility.

This is a Basic program which Pokes a machine-code program into the second cassette buffer. It should be safe enough there but if you want it somewhere else, it is relocatable without change. It is written for new-ROM Pets so users of old-ROM machines should make the following changes:

- Line 100, change 154 to 167
- Line 100, change 97 to 179
- Line 110, change 97 to 179
- Line 110, change 98 to 180

The line

POKE 1, 58:POKE 2,3

is used to initialise the program and then it is used with the statement

X = USR(A):PRINT A$

where A is the screen position and A$ is the string to be printed.

This article started with logical arithmetic and in case you thought you had seen the last of it I am going to finish with it. A number of computers, including the Apple and the Pet, have a Wait statement which is useful. This causes the program execution to halt until some preset condition is achieved. The statement has the form

WAIT X,Y,Z

and the computer will wait until the contents of location X — usually a port — And Y Exclusive Or Z gives a non-zero result. It does not matter that this is such a mess because if your machine has no such function you do not need to understand it — just translate it. If you have an INP function you can mimic

10 WAIT X,Y,Z

with

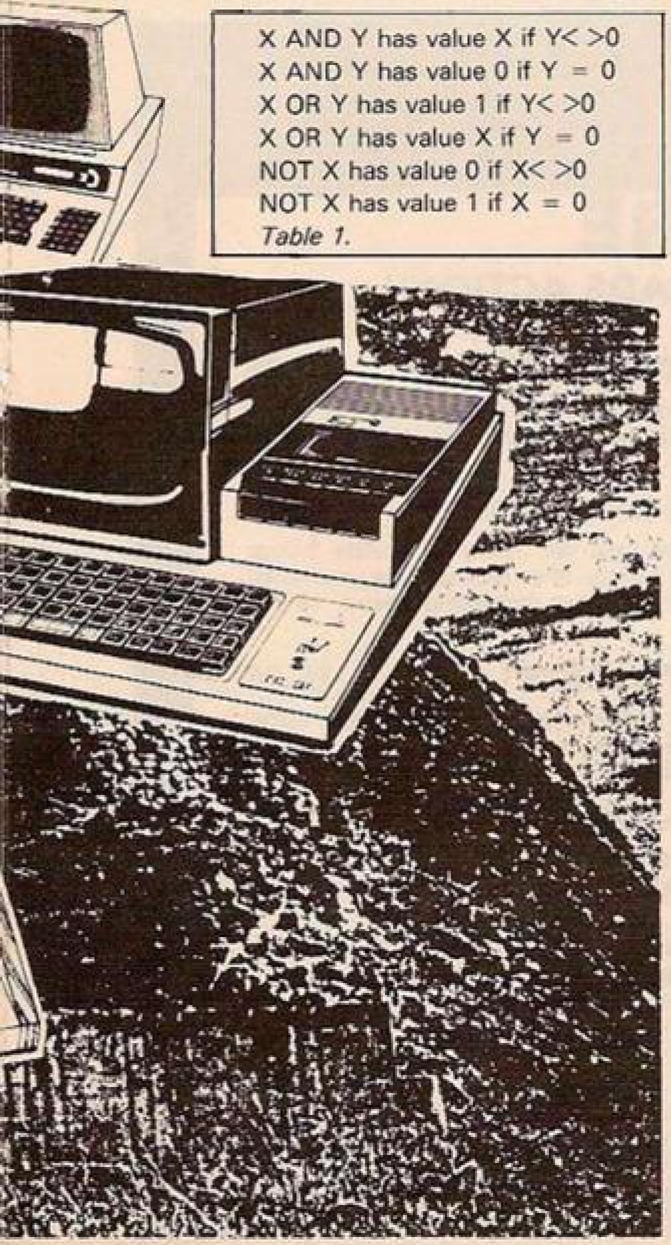
10 IF INP(X) = 2 THEN 20:GO TO 10

This function is usually used to halt Basic until some action is taken with hardware so it can be mimicked with Inkey$ if you have one using the loop:

100 A$ = INKEY$:IF A$ = ""THEN 100

which causes the machine to halt until a key is pressed or if you do not have Inkey$ a normal Input will stop Basic until you enter some dummy value.

Next month, in the final part of this series, I shall deal with the methods used to translate from one dialect to another when the dialects are so different as to make direct translation impossible. The method presented is capable of translating from one language to another and an example of such a translation will be given. ■



X AND Y has value X if Y< >0
X AND Y has value 0 if Y = 0
X OR Y has value 1 if Y< >0
X OR Y has value X if Y = 0
NOT X has value 0 if X< >0
NOT X has value 1 if X = 0

Table 1.

```
10 PRINT "INPUT RANDOM NUMBER
   SEED"
11 INPUT S
.
.
.
.
.
1000 REM PSEUDO-RANDOM NUMBER
     GENERATOR
1010 T = S/3001
1020 I = INT(T)
1030 R = T-I
1040 S = S+17
1050 RETURN
```

Program 2. Pseudo-random number generator.

```
100 DATA 32,154,208,169,19,32,210,255,
    230,97
110 DATA 164,97,169,29,166,98,240,8,202,
    32
120 DATA 210,255,224,0,208,248,136,208,
    245,96
130 FOR X = 826 TO 855
140       READ Y
150       POKE X,Y
160 NEXT
```

Program 3. Pet Print @ routine.

Action	Pet	TRS-80 II and Genie	TRS-80 III	ZX-81
Clear screen	(147)	—	(27)	—
Clear to end of line	(22)	(30)	(23)	—
Clear to start of line	(150)	(29)	—	—
Clear to end of screen	—	(31)	—	—
Cursor up	(145)	(27)	(254)	(112)
Cursor down	(17)	(26)	(255)	(113)
Cursor left	(157)	(24)	(252)	(114)
Cursor right	(29)	(25)	(253)	(115)
Cursor home	(19)	(28)	—	—

Table 3. Chr$ codes.

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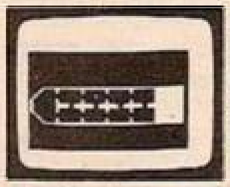
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SECRET MESSAGES This message coding program is very txlp qexi jf.
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CASSETTE 4

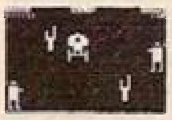
8 games for 16K ZX81

ZX-SCRAMBLE (machine code)

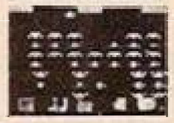


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GUNFIGHT (machine code)



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SOFTWARE

ATOM FILE HANDLING

George Byrns' trio of assembler routines provides the search, insert and delete functions that you need to handle the files which make up your Acorn Atom database.



DATABASES are collections of information designed to allow you quick and easy access to the necessary data. A simple database sits in the corner of every office in the country, in the guise of a filing cabinet.

The more powerful the management system of the database is, the more choice you have of ways of interrogating the information base. Typical databases would be personnel records, payroll, scientific results, sales figures and mailing lists organised into files. A sophisticated database consists of a suite of programs accessing and working on many different files to provide the user with information.

Files are the nuts and bolts, and they can be classified as sequential, indexed or random access. Sequential file structures, sometimes known as serial files, have their information stored as records in memory, one after the other, head to tail. One important advantage of this style is the simple structure which makes program writing easier and less time-consuming.

Once you have created the file you must make it easy to use. File management is carried out by a trio of assembler routines euphemistically known as SID. These three routines perform the search, insert and delete functions that are necessary. The search routine is a simple linear search, that is to say it starts at the beginning of the file and works its way through each record, searching on the first three characters of each record.

If the search is successful the record will be printed out, if not the search flag will be conditioned and an appropriate message displayed on screen. Remember this search is conducted on a particular record's label, so as long as the key is unique you do not have to worry whether the rest of the record is similar to others. For example, you could use the last three digits of an invoice number as a label and the goods, price and date as the rest of the record. If the key cannot be guaranteed, just prefix each record with a three digit number from, say, 000 to 999 giving 1,000 unique labels but at the cost of a three-byte overhead for each record.

This search routine is also utilised by the insert and delete routines — not surprisingly since in order to delete a record you first need to find its position in the file. The search flag is again used to flag messages to the user in the event of unsuccessful searches when deleting or trying to insert a record that already exists.

The file is created or loaded back into the upper text space with the pointers to the file base set at #8205 thus allowing space for the file parameters Filelen and Recordlen to be saved with the file. With only 6K of storage you need to be fairly concise. Naturally, with a disc drive, the program could be developed into a really powerful tool, as this would load the files in a matter of seconds, giving the capability to search through vast amounts of information in a minute or so.

The program is menu-driven and upon selection of a function a jump to the appropriate subroutine is performed along with error checking. To end a function and return to the menu the colon is recognised as end of function.

Suppose an estate agent had set up a file of all the properties on the market. Details listed could include the area of the city, detached or semi-detached, number of bedrooms, central heating and price. A prospective buyer might come into the office and ask for all properties in a particular area of the city, or request details of four-bedroom detached properties, in a specific area and with central heating. Here the multi-search comes into play.

This routine performs a global search on up to three target strings simultaneously and returns all the records that satisfy the search parameters. The target strings can be any

length, subject to the maxima defined by the user, and it does not matter whether the requested order is the same as that occurring in the file.

In the estate agent's case, the multi-search function would be selected and the area or post-code entered in response to the first question. A colon would then be entered in answer to the next question since only one attribute need be searched. Following this all the properties in the specified area would be printed. The second example would be just as easy to perform with the results duly printed out within a few seconds.



This routine is a more sophisticated version of the simple linear search which should become obvious from the flow diagrams and assembly listing and offers a great deal of flexibility in the way a file can be interrogated. There is plenty of scope for development. For example, you could search for and manipulate numerical data to provide tables, totals and averages.

The program could be used for holding details of club membership — streamlining membership renewal and mailing of newsletters, general mailing lists, cataloguing and cross-referencing journals or even as a language translator. I intend to develop the program further by providing the ability to search by fields if desired and incorporate relational testing of data.

Any 6502-based system with the necessary free space in zero page could run this program, but remember Atom Basic has its peculiarities. "$" is the string address operator and it specifies that the value following it is the address of the first character of a string. $A is analogous to A$ in other Basics.

The query "?" operator can be considered to be the equivalent to Peek and Poke depending upon its context. The "!" sign can also be considered as a Peek or Poke but this time instead of operating on a single byte it operates on a word and in Atom Basic a word is four bytes long. The apostrophe used in Print and Input statements generates a carriage return followed by a line feed.

```
1    REM     FILE HANDLING PROGRAM     G.BYRNS
5    N = 64
10   DIM LL(30),R(N),S(N),T(N)
15   FOR I = 1 TO 30; LL(I) = -1; NEXT I
98   FOR I = 1 TO 2; DIM P(-1)
99   PRINT $21
100   [
         INSERT ASSEMBLY CODE
998   ]
999   NEXT I; PRINT $6; REM TURN SCREEN BACK ON
1005  !#84=0
1006  INPUT " ARE YOU USING AN EXISTING FILE ", $R
1007  IF $R = "Y" THEN ?#87 = ?#8202; ?#84=?#8201
1009   REM PLACE BASE ADDRESSES OF STRINGS INTO ZERO PAGE LOCATIONS
1010  ?#85 = R; ?#86 = R&#FFFF/256
1015  ?#97 = R; ?#98 = R&#FFFF/256
1020  ?#9A = S; ?#9B = S&#FFFF/256
1025  ?#9D = T; ?#9E = T&#FFFF/256
1500  PRINT $12,"                MENU"'
1510  PRINT "1.........INSERT DATA"'
1520  PRINT "2.........SEARCH FOR DATA"'
1530  PRINT "3.........MULTI-SEARCH"'
1540  PRINT "4.........DISPLAY COMPLETE FILE"'
1550  PRINT "5.........DELETE COMPLETE FILE"'
1560  PRINT "6.........CREATE FILE"'
1570  PRINT "7.........CLOSE FILE"''''
1600  INPUT A; REM  INPUT CHOICE
1610  IF A<1 OR A>7 THEN GOTO 1600
1620  GOSUB ((A*1000)+1000)
1700  GOTO 1500, REM  GO BACK TO MENU
2000  INPUT "TYPE IN DATA"' $R
2010  IF LEN(R)>N OR.LEN(R)>?#87 THEN PRINT "RECORD TOO LONG"'; GOTO
2000
2020  IF ?R = ":" THEN RETURN
2030  LINK LL5
2040  IF ?#96>0 THEN PRINT "RECORD ALREADY EXISTS"'
2050  GOTO 2000
3000  INPUT "TYPE IN 3 CHARACTER LABEL"' $R
3010  IF LEN(R)>3 THEN GOTO 3000
3020  IF ?R = CH":" THEN RETURN
3030  LINK LL0
3035  IF ?#96 = 0 THEN PRINT "NO SUCH RECORD "';GOTO 3000
3040  PRINT $(?#83*256 + ?#82)'
3050  GOTO 3000
4000  C = 0
4010  INPUT "TYPE IN SEARCH LABEL"'$R
4020  IF LEN(R)>?#87 OR LEN(R)>N THEN PRINT " TOO LONG"'; GOTO 4010
4030  ?#99 = LEN(R); C = 1
4040 INPUT "TYPE IN SECOND LABEL"' $S
4050  IF ?S = CH ":" THEN GOTO 4085
4055  IF LEN(S)>?#87 OR LEN(S)>N THEN PRINT "TOO LONG"'; GOTO 4040
4060  ?#9C = LEN(S); C = 2
4065  INPUT "TYPE IN THIRD LABEL"' $T
4070  IF ?T = CH":" THEN GOTO 4085
4075  IF LEN (T)>?#87 OR LEN(T)>N THEN PRINT "TOO LONG"'; GOTO 4065
4080  ?#9F = LEN(T); C = 3
4090  LINK LL14
4095  PRINT "PRESS ANY KEY TO CONTINUE"; LINK #FFE3; RETURN
5000  J=0; PRINT $14; REM TURN PAGED MODE ON
5010  FOR I = 0 TO ?#84-1
5020  PRINT $(#8205 + J)"'
5030  J = J + ?#87
5040  NEXT I; PRINT $15; REM TURN PAGED MODE OFF
5050  LINK #FFE3; RETURN; REM WAIT FOR ANY KEY TO BE TURNED ON
6000  INPUT "TYPE IN THREE CHARACTER LABEL"' $R
6010  IF LEN(R)>3 THEN GOTO 6000
6020  IF ?R = CH":" THEN RETURN
6030  LINK LL9
6040  GOTO 6000
7000  INPUT "TYPE IN RECORD LENGTH"' B
7010  IF B>64 THEN GOTO 7000
7020  ?#87 = B
7030  DO
7040  INPUT " TYPE IN DATA "' $R
7050  ?#90 = LEN(R)
7060  LINK LL5
7070  UNTIL ?R = CH":"
7080  RETURN
8000  ?#8202 = ?#87; ?#8201 = ?#84; @ = 1
8010  PRINT ',"*SAVE DATA FILE FROM 8200 TO "
8020  PRINT & 8205 + ?#87*?#84,'
8999  END
```

```
                 Search
LL0   Start            LDA 80       Filebase
                       STA 82       Point
                       LDA 00
                       STA 96       Clear search flag
                       LDA 81       Filebase + 1
                       STA 83       Point + 1
                       LDX 84       File Len
                       BEQ LL3      Out    check for zero length file
LL1   Look             LDY 82
LL2   Again            LDA(82),Y
                       CMP(85),Y
                       BNE LL4      Next record
                       DEY
                       BPL LL2      Again
                       LDA  @FF
                       STA 96       Set flag if found
LL3   Out              RTS
LL4   Next Rec         DEX
                       BEQ LL3      End of file ?
                       CLC
                       LDA 87       File len
                       ADC 82       Point
                       STA 82       Store into Point
                       BCC LL1
                       INC 83       Increment Point + 1
                       JMP LL1
                 Insert Routine
LL5                    LDY 00
                       LDA @58
                       CMP(85),Y
                       BEQ LL8      Check for finish character - a colon

                       JSR LL0      Search
                       BNE LL8
                       LDX 84       File Len
                       BEQ LL6      Insert
                       CLC
                       LDA 82       Point
                       ADC 87       Record Len
                       STA 82       Point
                       BCC LL6      Insert
                       INC 83       Point + 1
LL6   Insert           INC 84       File Len
                       LDY 00
                       LDX 87
LL7   Loop             LDA(85),Y    Object
                       STA(82),Y    Point
                       INY
                       DEX
                       BNE LL7
LL8   Out              RTS
                 Delete Routine
LL9   Delete           JSR LL0      Search
                       BEQ LL13     Out     if not found
                       DEC 84       File Len
                       DEX
                       BEQ LL12     Done    any entries left ?
LL10  Add Rec Len      LDA 82       Point
                       CLC
                       ADC 87       Record Len
                       STA 88       Temp-point
                       LDA 00
                       ADC 83       Point + 1
                       STA 89       Temp-point + 1
                       LDY 87       Rec Len
LL11  Loop             DEY
                       LDA(88),Y    Temp-point
                       STA(82),Y    Point
                       CPY 00
                       BNE LL11     Loop
                       DEX
                       BEQ LL12     Done
                       LDA 88       Temp-point
                       STA 82       Point
                       LDA 89       Temp-point + 1
```

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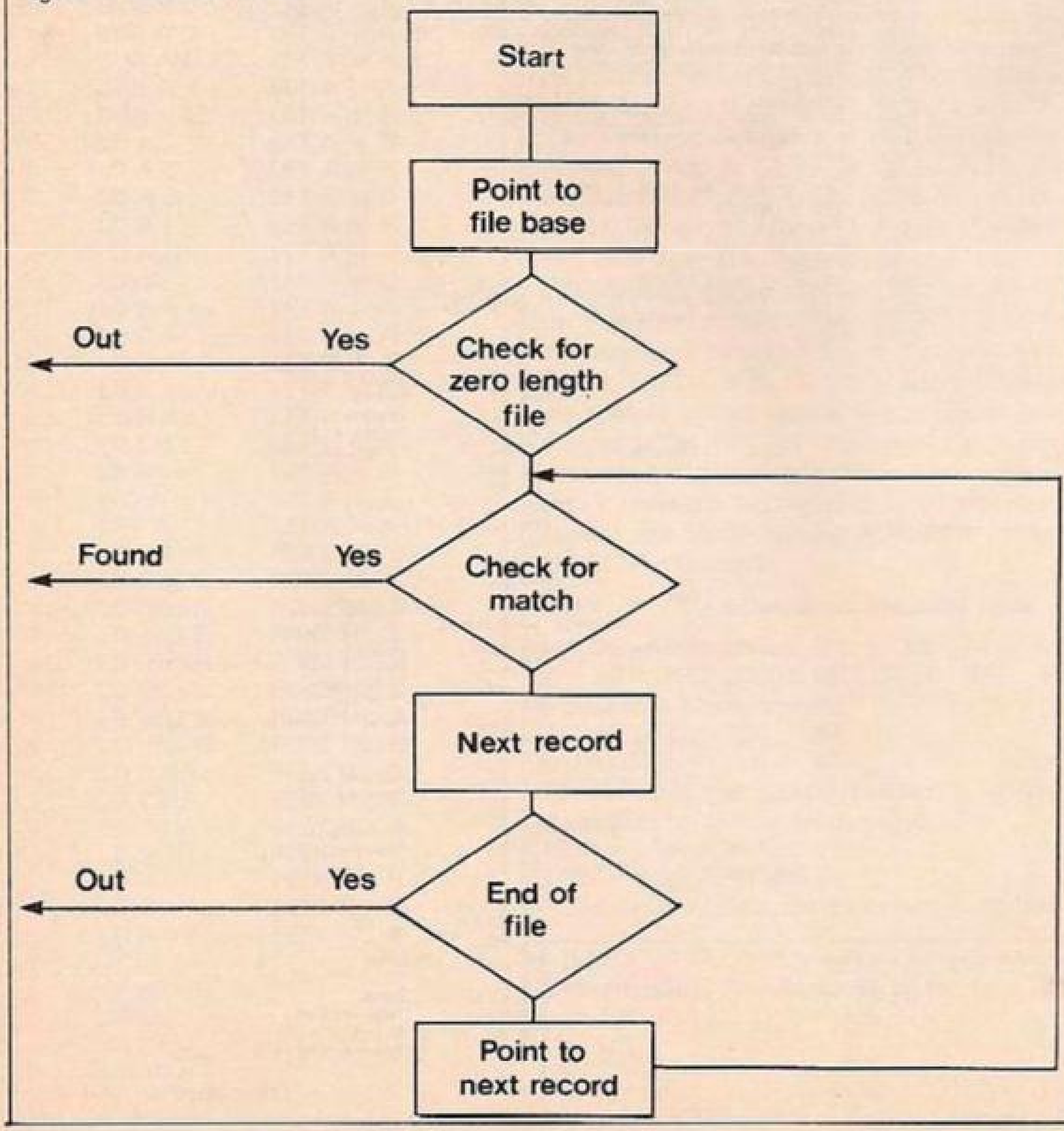
```
                    STA 83      Point + 1
                    JMP LL10    Jump to Add Rec Len
LL12  Done          LDA @FF
LL13  Out           RTS
              Multi Search
LL14  Initialise    LDA 84      File Len
                    BEQ LL13    Out      check for zero file
                    STA 93      Temp-fileln .
                    LDA 324     Low byte of C
                    STA 92      Succes Count
                    LDA 80      Filebase
                    STA 82      Point
                    LDA 81      Filebase + 1
                    STA 83      Point + 1
LL15  Start Over    LDX @0
                    LDA 97,X    Fetch first object
                    STA 85      Object
                    INX
                    LDA 97,X
                    STA 86       Object + 1
                    INX
                    LDA 97,X
                    STA 90       String Len
                    STX 91       Temp X store
LL16  Begin         LDA 82       Point
                    STA 88       Temp-point
                    LDA 83       Point + 1
                    STA 89       Temp-point + 1
LL17  Look.         LDY @0
LL18  Again         LDA(88),Y    Temp-point
                    CMP @13      Carriage return
                    BEQ LL21     Next Record
                    CMP(85),Y    Object
                    BEQ LL19     Next Char
                    CLC
                    LDA 88       Temp-point
                    ADC @1
                    LDA 89       Temp-point + 1
                    ADC @0
                    STA 89
                    JMP LL17     Look
LL19  Next Char     INY
                    CPY 90       String Len
                    BNE LL18     Again
LL20  Found         DEC 92       Success Count
                    BEQ LL22     Print Record
                    LDA 91       Temp X store
                    TAX
                    INX
                    LDA 97,X     Fetch next object
                    STA 85
                    INX
                    LDA 97,X
                    STA 86
                    INX
                    LDA 97,X
                    STA 90       Object length
                    STX 91       Temp X store
                    JMP LL16     Begin
LL21  Next Record   DEC 93       Temp-fileln
                    BEQ LL25     Out
                    LDA 324
                    STA 92       Success count
                    CLC
                    LDA 82       Point
                    ADC 87       Rec Len
                    STA 82
                    LDA 83       Point + 1
                    ADC @0
                    STA 83
                    JMP LL15     Start Over
LL22  Print Record  LDY @0
LL23  Cont.         LDA(82),Y    Point
                    CMP @13      Carriage return ?
                    BEQ LL24     Done
                    JSR FFF4     Print char to screen
                    INY
                    BNE LL23     Cont.
LL24  Done          LDA 324
                    STA 92       Restore success count
                    JSR FFED     CR/LF
                    JMP LL21     Next Record
LL25  Out           RTS
```

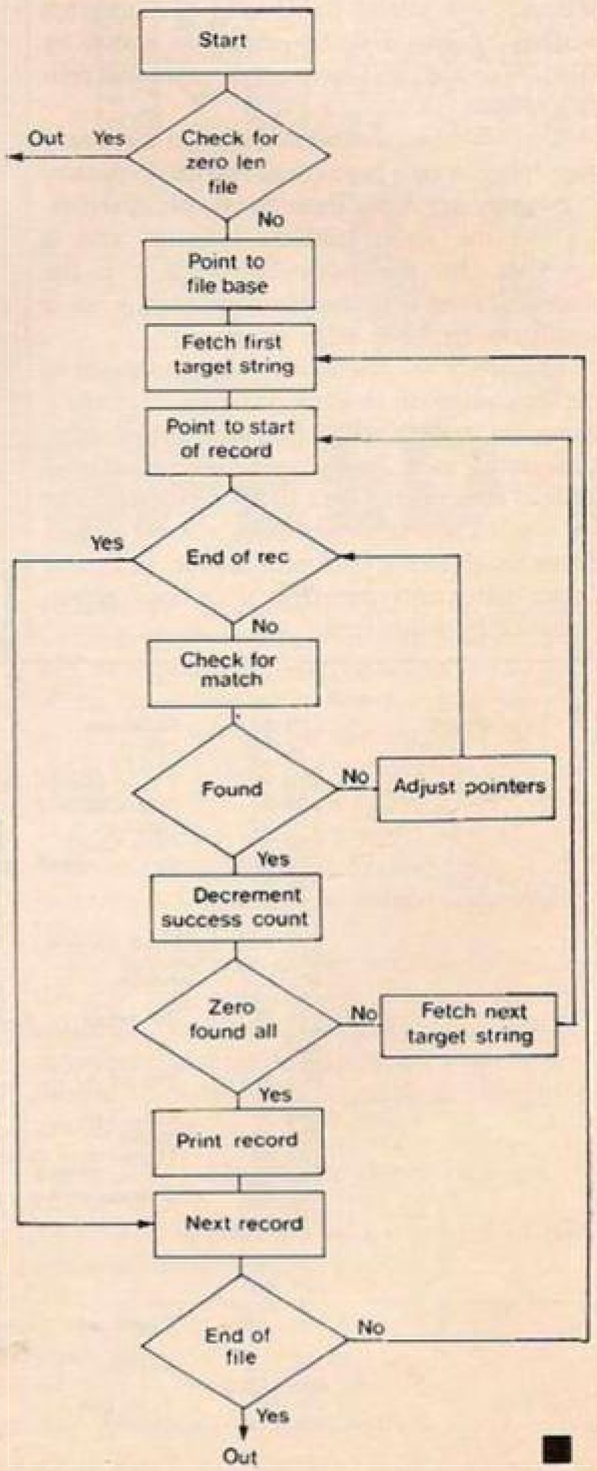
Figure 2. The multi-search.

The zero-page locations.

Filebase	80	Record Len	87
Filebase + 1	81	Temp-pointer	88
Pointer	82	Temp-pointer + 1	89
Pointer + 1	83	String Len	90
File Len	84	Temp X store	91
Object	85	Success count	92
Object + 1	86	Temp file len	93

Figure 1. The linear search.





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PROJECT ASIMOV AS A DATABASE

John Dawson's Asimov word processor can offer some of the facilities of a database. Here he shows how these techniques could be used to classify a cellar of wine.

A VAST AMOUNT of work has been done on mainframe computers to find efficient ways of accessing parts of a collection of data in order to produce lists or reports that are useful to organisations or individuals. Data in this sense is a resource that is stored, manipulated and output from the computer for a multitude of tasks.

Extending programs

Word processors originally grew out of the need to write and edit source code for big mainframe computers. In the same way a microcomputer word-processing program can be used for other purposes than simply writing and printing text. Word processors like Asimov can be extended into database systems by adding commands.

Asimov will not be a true database management language. A database language should allow you to interrogate a collection of information in any way that you determine, rather than by one of a few limited routes built into a program.

Information held in a computer may take many forms. Data is conceptualised as letters or numbers, truth values, references or program instructions; but it is in fact only a stored value. A program instruction may have exactly the same binary value as a relative address or the letter 'k'. The description given to the stored value is an attribute of the data. A data attribute identifies an area of RAM and provides information as to how the contents of that RAM should be treated.

Implicit attributes

Attributes may be implicit; for example, the second byte of a machine-code instruction is an address rather than the instruction to the Central Processor Unit. Alternatively, the data attributes may be explicit and very high level, the information listed in figure 2 is grouped in a structured form and each record starts with a control line:

[...............

which contains a number of attributes of the data which follows.

The control line may contain 15 characters and the instructions in the extended version of Asimov will allow a user to search through a file of records, selecting those in which the control line matches a selection of attributes. This pseudo-database approach means that sorting through the records can be done only be examining that line and not by looking at names or other pieces of information within the record.

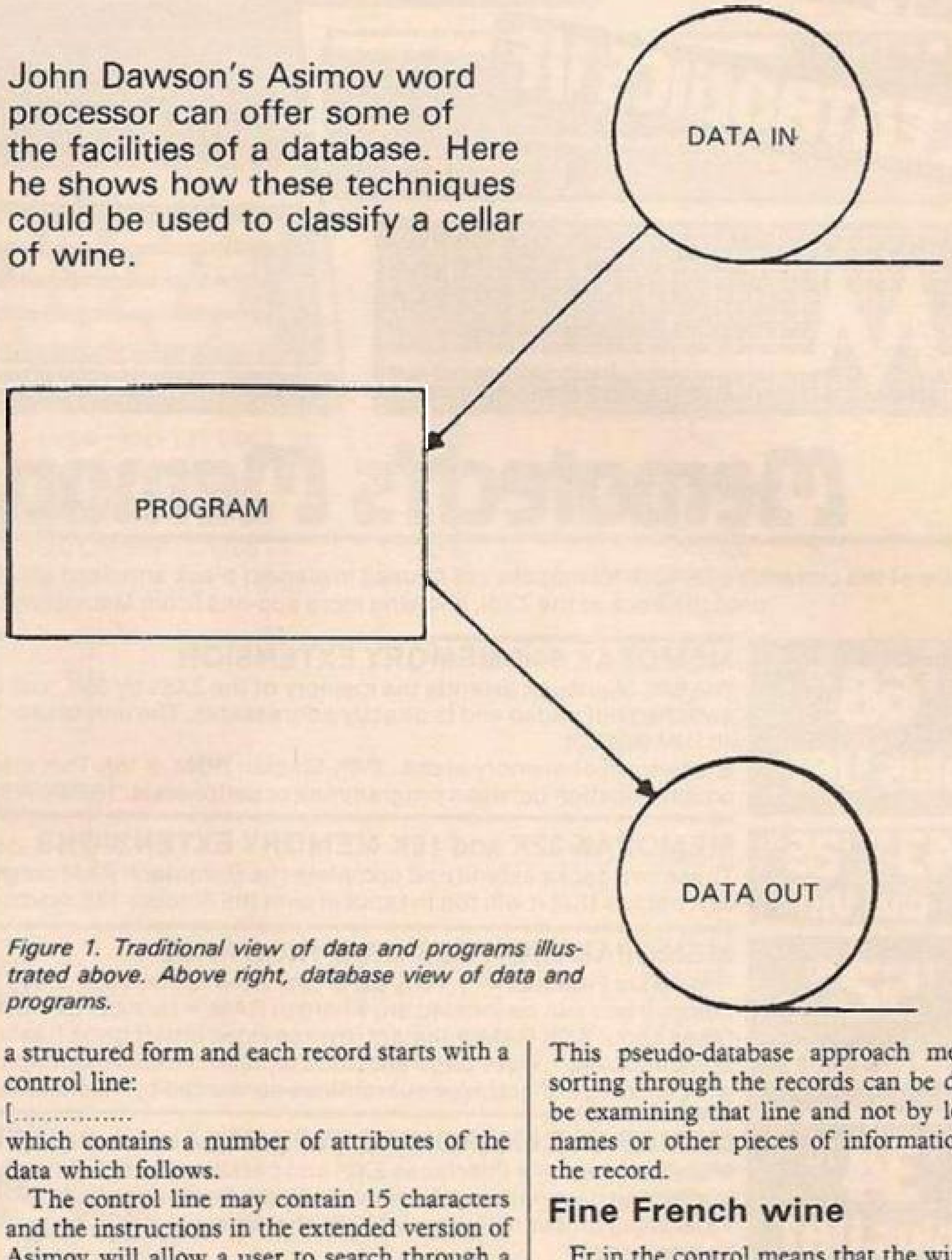


Figure 1. Traditional view of data and programs illustrated above. Above right, database view of data and programs.

Fine French wine

Fr in the control means that the wine comes from France; but suppose I want to know whether the collection contains any Cotes du

Definitions.

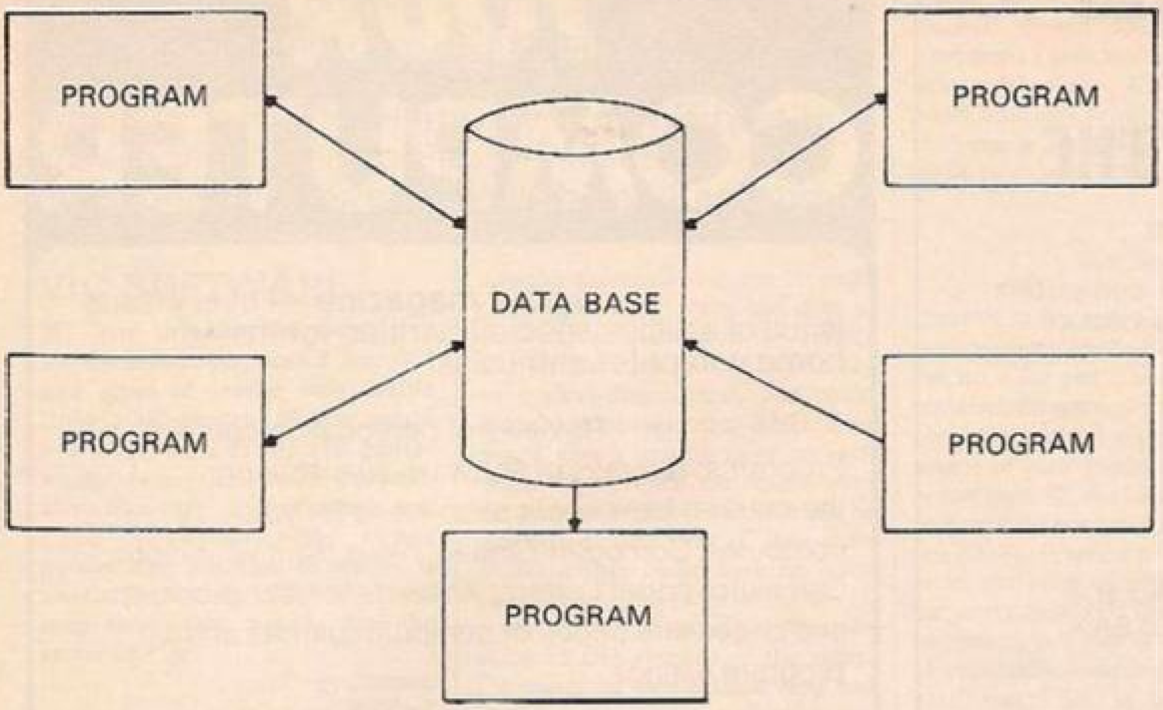
File — A file is a collection of records and will normally be a text in its own right. A file will be kept up to date by editing the text using Asimov. A combined text and record file is formed by retrieving the records first and then writing or appending the text.

Record — A record is a number of fields. The start of each field is identified uniquely within the record and the fields are linked or related to each other. For example, Rhone wine is manufactured in France and these two pieces of information will be linked in a record of a Rhone wine. Note however, that Rhone wine must be French; not all French wines are made in the Rhone area.

Field — The most basic part of the whole collection of information. Each field is terminated by a carriage return character to speed data input for name and address lists. Consequently each field is one paragraph long.

Figure 2.

```
[DUMMY..........
^1 Name
^2 Year
^3 Country of Origin
^4 Grape
^5 Shipper
^6 Date bought
^7 Bottles left
^8 Tasting notes]
```



HANDICAPPED COMPETITION

In Information Technology Year, *Your Computer* is sponsoring a competition to aid the handicapped. The competition, which is divided into two sections, is to design a device which helps disabled people to use a microcomputer to overcome their handicaps. All entrants to the competition must write up to 2,000 words describing such a device. In addition, entrants over the age of 18 will be expected to show a prototype device in action. More information about the competition and its rules will be found in *Your Computer,* April edition. The competition closes on August 31.

Luberon, the only way to find out is to print all the French wines. It is possible to find the words Cotes du Luberon with the Find command in Asimov and then print the record from there, but that is still not a real database.

The commands are nevertheless a useful and powerful way of storing, manipulating and retrieving information.

Some word processors allow you to write an address list and then generate standard letters with personal names incorporated into the letter. Asimov does not include this facility because it was designed to help write articles and books. The quality of the typeface produced by dot-matrix printers is legible and acceptable for draft articles or, for clubs and campaigns where the primary need is to distribute information.

Mailmerge facility

In adding a mailmerge facility to Asimov it proved possible to provide extended instructions that could be embedded into a text and edited with the normal word processor commands. This provided a more flexible system for people to use. Writers about wine could use extended Asimov to store information such as

Name
Country of origin (CoO)
Region within the CoO
Type of grape
Red or White
Wine shipper's name or where bought
Date bought
Cost
How many bottles left
Tasting notes (free format comments)

There are a number of uses for this information. The writers may wish to access the tasting notes for a single wine or a class of wines in the course of preparing an article or may wish to write to a shipper enquiring whether such and such a wine is still available.

They may wish to produce a catalogue of their stock, listing the wines according to various features — White Burgundy, or all the wines from California.

Each of these uses requires the data contained within the collection to be accessed and printed by the computer in different ways.

In addition to the instructions in figure 3 a couple of others are necessary to separate the text from the record file but these are trivial.

Missing instructions

Many instructions are missing that would be considered essential in a true database language. Boolean operators should allow you to carry out NOT and OR comparisons on the data to achieve selections such as:

Print all the Red OR White Spanish wines

The present control line is a permanent And function for example Print those records that are French And Red would look like

[FR.R...........]

A proper database language would allow you to add columns of figures extracted from the file of records, to select records that fell within a range of criteria — all the wines bought between 1975 and 1980 — or to answer questions such as — How many wines did we buy in 1976?

Nevertheless, the power of simple commands should not be disregarded and one crucial element in the design of any collection of information is safe — the data is in a form suitable for further analysis by more sophisticated procedures. Sorting a selection of records in a file into a particular order according to some attribute, the name of the wine, for example, should be comparatively straightforward. ■

Figure 3.

This list of instructions will provide easy, flexible and powerful ways of intermixing and listing data and text. The characters at the head of each descriptive paragraph are arbitrary and specific to Asimov — another program could use entirely different codes. The codes should be easy to remember and not intrude into your normal writing.

>
Search through the files and find the next record that matches the current control line.

$n
Repeat instruction which forms part of a Repeat While loop. The instruction has no effect in its own right except to mark a position in the text. The $n instruction must be matched with a <n instruction. This pair of instructions causes the computer to jump to the character following the $n instruction while the End of File (EoF) flag is False. The EoF flag is set false at the start of the merge print function. The Repeat While pair can be used to print all the records in the file that match the current control line if a > instruction is included in the loop. Repeat While pairs may be nested.

?
Set of EoF flag to false. This instruction allows you to make more than one search through a file of records in the course of printing a document. For example, if you want to produce a list of all the Italian red wines in the collection the text could look like this:

List of Italian Reds and French White wines at 18 August 1982.
ITALIAN REDS
[IT.R...........]
$1 > ∧1∧2∧7
<1
FRENCH WHITE
[FR.W...........]
$2 > 1 2 7
<2
End of list

When the program has completed printing the first selection of Italian red wines it will continue to print the heading for the next section and will then restart it's search through the file for all the French white wines.

∧ x
Print the field in the current record that corresponds to x. Each field may be of unlimited length and is terminated by a <Return> character. A record may have up to 62 fields — the identifier following the field marker is supplied automatically by ASIMOV when a record is typed. You may have only one record in the computer, comprising a number of standard paragraphs for flat leasing, for example, which are called up as necessary.

[...............]
Sets the control line to the characters inside the square brackets. A full stope is a "wildcard" and will match with any character so that an "empty" control line of 15 full stops will print all the records.

?
Print the current serial number. A variable is set to zero at the start of a print merge operation and this variable is incremented and printed at the present position of the printer. This instruction is useful for numbering items in a catalogue or list.

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

VIC SOFTWARE

■I am thinking of buying a Vic-20 computer, and I am sick and tired of seeing only feeble little 3.5K games. Please could you inform me of any 16K games available for the Vic-20. I especially like the complicated but good Adventure and space games like Starfighter which is available for the TRS-80. I am sure that other people feel the same as I do.

Gregg Barnett,
Adbaston, Stafford.

If availability of software is one of the main factors influencing your choice of computer, I suggest you look at the software first, and pick up the computer from that. The Vic-20, the TI 99/4A and the Atari 400 are now very close in price, and all offer computer power with plug-in cartridges. Atari's Star Raider is possibly the most impressive game on the market, but reviews of the same company's answer to Pacman have been far from favourable. Whichever machine you buy, you will have to accept some compromise — price against facilities, available software against ease of programming. The new Dragon 32 has at least five cartridges already available, and this may well be worth considering. Software for the Spectrum is already available, and the quality of the first programs I have seen suggests that you may be able to satisfy your game-playing needs with a Spectrum. To repeat my first suggestion, rather than criticise a particular machine for not having the programs you want, look for the games you want, and then see which machine supports them best.

FA CUP DRAW

■An idea came to me when the FA Cup Draw was made. I could do my own computerised FA Cup draw. I immediately set about this, thinking of different ways to accomplish it. I have an idea on how to select a random football team, but the more I think about this, the longer the program seems to become. Also, after two teams have been drawn together, how do you ensure that the same two teams do not reappear again?

John A Stonier,
Welwyn Garden City, Hertfordshire.

It is difficult to give you specific advice, as I do not know how you have set the program up. However, if you base it on arrays, and the draw is held within an array, you could consider dimensioning one or more extra depth in the array, and store in this extra dimension a unique number for each team. If the array were three-dimensional, you could allot the third element to RND. This would give a unique value to each team. Then, when the teams were drawn together these values could be checked. If, and only if, they were different they could both be made equal to a third value of RND. If, however, they already held the same value in this element of the array, the computer would know they had already been drawn together.

INTRODUCTORY BOOKS

■I recently purchased a ZX-81 to help my daughters who are 11 and nine to acquire skills in using and understanding computers. It was not as easy as I had thought and now the computer is seldom used. I find the instruction book rather hard work. I have my first copy of *Your Computer* with so many advertisements for books for novices such as myself, I am wondering if you can advise me at all. The choice is bewildering.

Sue Bougard,
Harestock, Winchester.

This is almost as difficult a question to answer as "Which is the best computer?", and made more difficult for me as I have written a few of the books which are among the bewildering number available. I will try to be impartial, which is difficult in the circumstances. In my opinion the books which you should consider as first-timers' books include, but are not necessarily limited to *ZX-81 Basic Book* by R Norman, *The ZX-81 Pocket-Book* by Trevor Toms, and *Getting acquainted with your ZX-81* by Tim Hartnell. When you've covered the material in these books, you could look at *The Explorer's Guide to the ZX-81* by Mike Lord, and *Byteing Deeper into your ZX-81* by Mark Harrison.

LOOSE ADAPTOR

■When my Sinclair ZX-81 arrived it worked perfectly for about two months and then the 9V DC input plug from the adaptor to the computer became loose, and the slightest jog cleared the screen. I took it back, and received a replacement. Since then it has become loose a further three times. The problem is that the only thing that holds the adaptor plug in place is a strip of metal with a bump in it. This is gradually pushed down, and causes the problem. I was wondering if any other Sinclair ZX-81 owners have had this trouble, and if so, if there is anything that can be done to stop this happening?

P Bradbery,
Westkingsdown,
Near Sevenoaks, Kent.

Firstly, it is a very simple matter to replace the socket. Any electrician can do it for you. Once you have it replaced, do not continue to pull the plug in and out. I suggest that is the source of your trouble. Disconnect, or just turn off, the power unit at the wall, and do not touch the socket on the ZX-81. It seems to me you must be in the habit of pulling the plug out every time you finish using the computer, and this is a certain way of eventually ensuring it will work itself loose. So, in brief, find an electrician to replace it with the best socket he has, and then once you have the unit working, do not pull the plug out again.

ATARI OWNER

■Is there no-one out there in microland who has an Atari? As it is totally *Your Computer's* fault that I am now a pauper, I think you should help me. I knew nothing about computers until I foolishly bought a copy of your magazine. Then I was hooked. One question: can I use a cassette recorder with my micro other than the Atari one, or is it dedicated to the output, like the Vic-20 one?

Howard G Angel,
Harrogate, North Yorkshire.

You are not the only Atari owner. I have one, and so do tens of thousands of other people in the country. And now that the price of the 400 has dropped, there are certain to be more and more owners as time goes on. Yes, you do need to use the Atari cassette recorder, which is designed specifically and solely for the Atari computer. Although this is a disadvantage in terms of the cost, it is considered worthwhile by many because the load/save reliability of dedicated cassette machines tends to be higher than those which accept just any standard domestic recorder. My Atari recorder, for example, is considerably more reliable than my ZX-81/domestic recorder hook-up.

RANDOM MOVE

■I own a 16K ZX-81 and I am writing two programs that involve the random movement of two characters around a maze. What I cannot work out is how to change the direction of the character at random when it comes to either a three- or four-node junction. I was wondering whether you could help me?

Nick Flint,
Salisbury, Wiltshire.

Assuming your moving object is at locations Y,X. To move up, as you know, you subtract one from Y; adding one to Y to move down. Subtract one from the X value, and the object moves to the left, add one and it moves to the right. There are, in effect, four choices, and a few lines of code can be written to choose one of the four, and then make the necessary alterations in the value of Y and X. Try this routine, and then see if you can adapt it for your own program. The vital lines are 40, 50 and 60. It can easily be adapted for three directions.

```
 5 REM MAZE DECISIONS
10 LET X=10
20 LET Y=10
25 LET A=X
26 LET B=Y
30 PRINT AT Y,X;"■"
40 LET K=INT (RND÷4)
50 LET Y=Y-(K=0) + (K=1)
60 LET X=X-(K=2) + (K=3)
70 PRINT AT B,A;" "
80 GOTO 25
```

ALIEN EXPLODES

■I have a ZX Spectrum on which I am expanding my programming knowledge. My problem is trying to fire a missile from a base, and if it hits an alien, making that alien explode. I have heard this is something to do with graph co-ordinates, but on trying to apply this to a program, I have had no success.

Jason Hodges,
Brentwood, Essex.

You have not said exactly what your problem is, but I guess you want to know how the missile knows it has hit an alien. You can use the ATTR function which can tell when the missile is just about to run into a character cell which contains an alien. ATTR, which is used in the form ATTR(Y,X), where the Y is the co-ordinate down the screen, and the X is the co-ordinate across it. You are printing the missile with Y and X as

```
PRINT AT Y,X;"*"
```

You need to write a few lines to check the attributes of the square Y,X before the missile is printed there. The number actually produced by ATTR depends on whether the character is flashing or not, whether it is bright or not, and the colours of the Ink and Paper at that position. Because ATTR seems to me to be a little unpredictable in practice, it seems best to set up a routine to print out the results of ATTR before you finally decide what value you wish to test for. The absence of a value produced when the missile moves over a blank background is not recommended. Instead of this, test for the presence of a particular value. You can do this when writing a program by including a temporary line of the type

```
PRINT AT 0,0;ATTR(Y,X)
```

then watching what happens to this value when the missile is just about to move into a cell occupied by an alien. ■



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FINGERTIPS

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

THIS MONTH I am going to stand down and hand the column over to four contributors, two of whom are from a growing band of overseas correspondents. You may note three of the programs are written for the Casio calculators. This reflects the majority of the Fingertips mail-bag — so Texas Instruments, Hewlett-Packard and Sharp users should wake up, and start submitting some of their more inspirational material.

The program will give the distance from your town to any location in the world in miles, or kilometres if required, writes Andrew Shelbourne of Chesterfield, Derbyshire. I am a radio enthusiast and it is often useful to know how far a broadcasting station is from my location. It is written to run on the FX-180p.

You could also work out approximately how long a journey is or just use it out of interest. It proves to be much more accurate than the scales given on maps and atlases. The program must be used in conjunction with the index of an atlas to find the exact longtitudes and latitudes.

The calculation is based on the formula:

Cos D = sin La. sin Lb + cos La. cos Lb. cos Lo

Where D is the angle of area between two points; La is the latitude of first town; Lb is the latitude of second town; Lo is the difference in longitude between a and b. This formula was obtained from the *Radio communication handbook*, Volume 2 page 11.23 printed by the Radio Society of Great Britain. The flowchart in figure 1 shows how to use the program. A final note, if the latitude of either town is south of the equator, it should be negative. For example, Capetown is 33° 59″ south. Therefore enter it as −33° 59″. The flowchart may seem complicated but after a few calculations it becomes easy and one will remember whether a co-ordinate should be negative or not.

After entering the program, put

69.06 kin 4
1.151 kin 5

and your latitude in k memory 1. For example:

53°999 15°999 kin 1

For distance in kilometres, put

111.2 kin 4 1.853 kin 5

Mode 0 P1	13 kout 1	25 ENT
01 ENT	14 COS	26 ×
02 +	15 ×	27 kout 4
03 ENT	16 kout 2	28 =
04 =	17 COS	29 Min
05 kin 3	18 ×	30 kout 6
06 kout 1	19 kout 3	31 inv °999
07 SIN	20 COS	32 ENT
08 ×	21 =	33 ×
09 ENT	22 COS^{-1}	34 kout 5
10 kin 2	23 kin 6	35 =
11 SIN	P2	36 M+
12 +	24 inv °999	37 Mr

Figure 1. Select P1

If towns are on same side of the Equator:

Enter largest longtitude
RUN
↓
Enter smallest longtitude in negative form, i.e., 5° 3° 6.
RUN
↓
Enter latitude of other town
RUN
↓
Press Inv P2

If one town is west and other is east:

↓
Enter longtitude of your town
RUN
↓
Enter longtitude of other town
RUN
↓
Enter latitude of other town
RUN
↓
Press Inv P2

↓
Enter number of degrees, e.g., if 4° 8° 5 is displayed, press 4 RUN
↓
Enter number of minutes, e.g., if 4° 8° 5 is displayed, press 8 RUN
↓
Distance from your town to other town is displayed in miles.

Here is the old favourite game of mastermind, but this time for the PC-1211 pocket computer, writes Robin Ager of Wimbledon, London SW19. The idea of the game is to guess the computer's four-digit number, each of which can be the numbers 1 to 9. No numbers appear twice in the computer's code.

The computer marks correct numbers in the correct place and correct numbers in the wrong place.

The program uses 564 steps. When typing in the program do not type semi-colons after the line numbers.

This jackpot program for the Casio FX-602P was originally written for the FX-502P, and after purchasing the FX-602P, I altered it a little, and improved the read-out, writes Fred de Heer of IJmuiden in the Netherlands.

Before entering the program MODE 3, invMAC, MODE 2, MODE .20 must be executed, to put the calculator in the correct format. For ending an Alpha-statement in the WRT mode, FST is used instead of invA1, which works as well.

The words in the Alpha-statements in the program are written without commas for separation, as well as the two-digit numbers in the normal status. With most inverse button-functions, inv is deleted on the program.

In the program, several extra RAN# functions have been added to reduce the possibility of repetition of combinations, after you have played for a time. Since it uses 502 steps and 22 data registers, the program can only be used in the FX-602P, and possibly in a calculator of the 700-series.

After inserting the program, followed by Mode 1, the jackpot is initiated with P9 — twice, if the credit counter equals 0 and reads out the following:

```
10 ■  — —
↑      1  2  3 ← reel number
credits
```

P0 decreases the credit counter by 1 and starts the jackpot, displaying a digit for reels 1, 2 and 3, followed by

WIN: X

if the combination is a winning one.

The win may be collected, P0 or EXE, or can be gambled, P4, after

(continued on next page)

```
1:"A"CLEAR
3:INPUT"ENTER A NUMBER(1-1000)";X:X=X/1000
4:M=0:FOR Y=1 TO 4
5:T=147*X:T=T-INT(T):X=T:T=INT(T*10)
10:IF T=0 THEN 5
15:A(Y)=T
16:NEXTY
17:IF (A=B)+(B=C)+(C=D)+(A=C)+(B=D)<>1 THEN 20
18:GOTO 4
20:M=M+1:INPUT"ENTER YOUR GUESS ";Z
22:W=0:R=0
23:FORY=8TO 5STEP-1
25:Z=Z/10:J=(Z-INT(Z))*10:Z=INT(Z)
28:A(Y)=J
30:NEXTY
40:FOR Y=1TO4
45:FORQ=5TO8
50:IF A(Q)=A(Y)LETW=W+1
55:NEXTQ
57:IF A(Y)=A(Y+4)LET R=R+1
60:NEXTY
85:W=W-R
90:IF R=4THEN200
95:PRINT"RIGHT PLACE=";R;" WRONG=";W
110:GOTO 20
200:BEEP 3:PAUSE"WELL DONE YOU GUESSED IT"
210:FORY=1TO 3
212:PAUSE"************************":PAUSE"****** EXCELLENT
*******"
220:PAUSE"IT TOOK YOU ";M;" GOES"
222:NEXTY
225:INPUT"WANT TO PLAY AGAIN(Y/N)";U$
230:IF U$="Y" THEN4
240:END
```

Robin Ager's Mastermind program.

The matrix inverter by G Devilee.

```
MODE .25
PO: lbl0  MAC AC GSBP7
          MR01 × (MR05 × MR09 - MR08 × MR06) -
          MR02 × (MR04 × MR09 - MR07 × MR06) +
          MR03 × (MR04 × MR08 - MR07 × MR05) =
          "DET = $" HLT x = 0 goto1
          1 Min10 Min14 Min18
          MR04 ABS - MR01 ABC = x=>0 goto2
          MR07 ABS - MR01 ABS = x=>0 goto3 goto4
    lbl2  MR07 ABS - MR04 ABS = x=>0 goto3
          0 MinF 3 Min00 GSBP1
          0 Min10 Min14 1 Min11 Min13 goto4
    lbl3  0 MinF 6 Min00 GSBP1
          0 Min10 Min18 1 Min12 Min16
    lbl4  MR04/MR01 = Min00
          0 MinF GSBP2 3 +/- Min00 GSBP6
          MR07/MR01 = Min00
          0 MinF GSBP2 0 Min00 GSBP6
          MR08 ABS - MR05 ABS = x=>0 goto5 goto6
    lbl5  3 MinF 6 Min00 GSBP1
          12 MinF 15 Min00 GSBP1
    lbl6  MR02/MR05 = Min00
          3 MinF GSBP2 6 +/- Min00 GSBP6
          MR08/MR05 = Min00
          3 MinF GSBP2 0 Min00 GSBP6
          MR03/MR09 = Min00
          6 MinF GSBP2 6 +/- Min00 GSBP6
          MR06/MR09 = Min00
          6 MinF GSBP2 3 +/- Min00 GSBP6
          9 Min00 MR01 GSBP5 MR05 GSBP5 MR09 GSBP5
          9 Min00 MinIF 1 +/- Min22 GSBP7 goto0
    lbl1  "NO INVERSE" HLT goto0
P1:       18 Min1F
    lbl1  1 M+F M+1F M+00
          ind MRF ind Min1F ind MR00 ind MinF ind MR1F ind Min00
          MRF/3 = FRAC x = 0 goto2 goto1
    lbl2
P2:       18 Min1F
    lbl1  GSBP3 x = 0 goto2 goto1
    lbl2  6 M+F
    lbl3  GSBP3 x = 0 goto4 goto3
    lbl4
P3:       1 M+1F M+F
          MR00 × ind MRF = ind Min1F
          MR/3 = FRAC
P4:       6 M+00
    lbl1  1 M+F ind MRF +/- + GSBP8
          MRF/3 = FRAC x = 0 goto2 goto1
    lbl2
P5:       1/x MinF × GSBP8
          MRF × GSBP8 MRF × GSBP8
P6:       18 MinF GSBP4 GSBP4
P7: lbl0  1SZ MR00 - MR1F = Min19/3 + 4 1/x = F1X0 MinF
          MR19 - 3 × MRF + 3 = Min19 MR1F
          "A ar22 (arF. ar19)" x = 0 goto1 goto2
    lbl1  HLT ind Min00 goto3
    lbl2  PAUSE PAUSE ind MR00 F1X8 HLT
    lbl3  MR00 - 9 - MR1F = x = 0 goto4 goto0
    lbl4
P8:       1SZ ind MR00 = ind Min00
```

(continued from previous page)

which the combination win can be doubled or nothing.

If there is no winning combination in the display, each reel can be held with P1, P2 or P3. The hold can be cancelled with P4. Reels cannot be held with a winning combination or twice in succession.

Combination	Win	Combination	Win
9-9-9	50	3-3-3	14
9-9-8	50	3-3-8	14
8-8-8	24	2-2-2	10
7-7-7	20	2-2-8	10
7-7-8	20	1-1-1	10
6-6-6	18	1-1-8	10
6-6-8	18	0-0-0	8
5-5-5	18	0-0-8	8
5-5-8	18	-0-0	4
4-4-4	14	- -0	2
4-4-8	14		

9-9-9 is the jackpot and adds 50 credits and another 50 which can be gambled.

P0 Start/collect win
P1 Hold reel 1
P2 Hold reel 2
P3 Hold reel 3
P4 Gamble win/cancel hold
P9 Initiate/reset credit counter

Fred de Heer's jackpot game.

```
P0    invA1, ;, FST, MR04, X=0, GOTO0, GOTO7, LBL0, MR05, X=0, GOTO9,
      -, 1, =, Min05, GSBP5, 0, Min04, 3, Min00, LBL1, GSBP5, RAN#,
      RAN#, Xy, 1, 1,X ↔ Y, ÷, RAN#, -, X=0, GOTO1, -, 1, =, INT, IND,
      Min00, -, MR12, =, X≥0, GOTO1, MR06, X≥0, GOTO2,π , MinF, MR07
      Min1F, X =F, GOTO3, Min01, LBL3, MR08, M+1F, X=F, GOTO4, Min02,
      LBL4, MR09, M+1F, X=F, GOTO2, Min03, LBL2, DSZ, GOTO1, GSBP5,
      MR06, X≥0,  GOTO5, MR1F, ÷, 3, =, X=F, GOTO5, 0, Min06, MRF,
      Min09, Min08, MIn07, GOTO6, LBL5, 1, M-06, LBL6, MR03, MinF,
      MR02, X=F, GSBP6, MR04, X=0, GSBP7, MR04, X=0, GSBP7, MR04,
      X=0, GOTO7, invA1, WIN:, space, #, FST, HLT, LBL7, GSBP8, LBL9

P1    invA1, ;, FST, MR06, X=0, GOTO1, invA1, HOLD, →, ar03, →,
      ar02, →, ar01, FST, MR03, Min09, RAN#, M-06, LBL1, GSBP5

P2    invA1, ;, FST, MR06, X=0, GOTO1, invA1, HOLD, space, ar03,-,
      ar02, →, ar01, FST, MR02, Min08, RAN#, RAN#, M-06, LBL1, GSBP5

P3    invA1 , ;, FST, MR06, X=0, GOTO1, invA1, HOLD, space, ar03, -,
      ar02, →, ar01, FST, MR01, Min07, RAN#, M-06, LBL1, GSBP5

P4    invA1, ;, FST, MR04, X=0, GOTO0, 0, MINF, invA1, Gamble:,
      space, ar04, FST, RAN#, RAN#, x, 35, =, INT, Min00, LBL4, MRF,
      X!, invA1,  N, FST, 2, M+F, DSZ, GOTO5, LBL8, 0, invA1, ;,
      othing, FST, GOTO9, LBL5, MRF, X!, 1, M+F, invA1, E, FST,
      DSZ, GOTO6, 1, invA1, ;, ven, FST, GOTO9, LBL6, MRF, X!, 1,
      M+F, invA1, N , FST, DSZ, GOTO7, GOTO8, LBL7, MRF, X!, 1,
      M+F, invA1, D, FST, DSZ, GOTO4, 2, invA1, ;, ouble, FST, LBL9
      x, MR04, =, Min04, X=0, GOTO1, GOTO2, LBL1, 1, M-04, GOTO2,
      LBL0, MR06, X =0, GOTO2, invA1, ar05, space, ■, Cancel, FST,
      π, Min09, Min08, Min07, LBL2, GSBP8

P5    IND, GOTO0, LBL2, invA1, ar05, space, ■, space, ar03, -, space,
       -, space, FST, GOTO9, LBL1, invA1, ar05, space, ■, space,
      ar03, -, ar02, -, space, FST, GOTO9, LBL0, RAN#, invA1, ar05,
      space, ■,  space, ar03, -, ar02, -, ar01, FST, GOTO9, LBL3,
      invA1, ar05,  space, ■, space, space, -, space,-, space, FST,
      LBL9

P6    MR01, X=F, GOTO1, -, 8, =, X=0, GOTO4, LBL1, -, 9, =, X=0,
      GOTO3, GOTO2, LBL3, 50, M+05, invA1, JACKPOT, space, #, FST,
      PAUSE, LBL2, MR11, M+F, IND, MRF, Min04, LBL4

P7    MR01, X=0, GOTO1, 0, GOTO2, LBL1, MR02, X=0, GOTO3, 2, GOTO2,
      LBL3, 4, LBL2, Min04

P8    MR04, X=0, GOTO1, X≥0, GOTO2, GOTO3, LBL2, invA1, Collect:,
      space, #, FST, M + 05, LBL3, 0, Min06, Min04, LBL1, GSBP5

P9    MR05, X=0, GOTO1, 0, Min05, GOTO2, LBL1, 1, Min09, Min08,
      Min07, 50, Min19, 24, Min18, RND1, Min17, 18, Min16, Min15, 14,
      Min14, Min 13, RND1, Min12, Min11, Min05, LBL2, invA1, ar05,
      space, ←, Credit, FST, 8, Min10, AC, Min06, 3, Min00, GSBP5
```

This program runs on the Casio FX-602P and inverts a three-by-three matrix using the Gauss-Jordan method, writes G Devilee, Voorburg also in the Netherlands.

The user enters

A0 (1.1) - A0 (3.3)

to evaluate the determinant and the inverse matrix. When the determinant equals 0 then

"NO INVERSE"

is displayed. When the determinant does not equal 0, then an inverse is possible and

A-1 (1.1) - A-1 (3.3)

is displayed. The total number of steps used is 444.

Finally, another brain teaser,

$$\text{Let } g(n) = n+2\,(n-5)$$

and

$$c = \left[g\left(\frac{10}{3}\right)\right]^2$$

Can you write a program which will find the roots of

$$f(n) = 1-2\ \mathrm{enp}\left[\frac{-g^{2(n)}}{c^2}\right]$$

from first principles. ■

AF

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Dungeons

J Chalmers,
East Grinstead,
West Sussex.

ZX-81

MUCH HAS BEEN written about the speed and memory efficiency of ZX-81 machine code, although not many, long, solid machine-code programs have been published. Dungeons sets out to remedy this situation by providing an easily expandable, relatively lengthy maze game. The program occupies less than 2K, but more than 1K of RAM, and is expandable to occupy much more if you so wish.

It produces a maze of rooms, each with up to four doors. There are a total of 100 rooms on a 10-by-10 grid, and the player must decide which room to move to, by selecting either up, down, left, or right. He can only move in this direction, however, if there is a door. The aim is to reach what is known as the Zero Room — the top left-hand room on the square grid.

The program is constructed using program modules, each module performing a specific task and being called when needed by a command routine. Using this modular approach eases program design, and allows for unlimited expansion possibilities. The various modules must perform the following tasks:

- Construct the maze
- Display to the player, a plan view of the room he is in
- Perform the player's commands, up, down, etc.
- Keep a score

In the maze program, only the lower nybble of each byte within the maze area is used. This nybble describes the room; how many doors it has and where they are, in the format shown by figure 1, where a 1 represents a wall, and a 0 represents a door. If the nybble were to have the value 7, or 0111 binary, for example, this would indicate a wall in every direction except up, where there is a door.

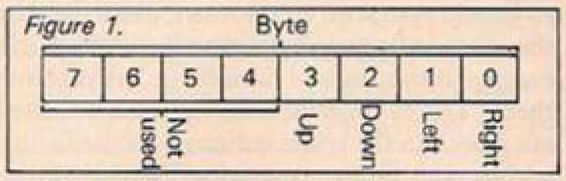


Figure 1.

Using this system of coding a maze can be set up simply by allocating each byte in the area of memory reserved for the maze, with a number between 0 and 15 — 0 to F. If these values are allocated randomly, a random arrangement of rooms can be constructed.

When the program is run, first the maze is set up. The random values for each room are chosen. As there is no easy way of producing random numbers in machine code, this is done using the Basic RND function. The values obtained are Poked into RAM between 16514 and 16614, the area reserved for the maze.

When all the values have been stored, the program jumps into machine code. The first routine to be executed is called "perimeter", and makes sure that a wall exists all around the maze so that the player keeps within its confines.

The second routine is called "legalise", and is the real maze producer. Its job is to look at each room in turn, and make sure that if a player goes, say, through a door on the right, he comes into the next room through a door on the left. When this routine has been completed, the maze is set up and ready to be wandered through.

The next routine to consider is the "print-room" routine which prints a plan view of the room which the player is in. The variable which holds the address of the player's position, is the system variable Seed at 4032. The room that the player starts in is chosen randomly by line 80 of the Basic program, which uses Rand to store the selected address in Seed. The data needed to print the walls and doors which make up a room, is stored between 4151 and 41AE.

The print-room routine decides which strings it should print by looking at the byte specified by Seed, and testing it using the bit instructions. It then calls a subroutine called "print data", which picks up each item of data from the chosen string, and prints it using the RST 10 instruction. A string is terminated by the presence of a 1B character.

Now that a plan of the room has been displayed, the next thing to do is print the scores.

(continued on next page)

```
ZX81 "DUNGEONS" By J.Chalmers 1982
16614 (40E6)          06 0A       Ld b,0A
                      21 82 40    Ld hl,4082
'PERIMETER'     #1    CB DE       Set 3,(hl)     Set top walls
                      23          Inc hl
                      10 FB       Djnz #1
                      06 0A       Ld b,0A
                      11 0A 00    Ld de,000A
                      21 82 40    Ld hl,4082
                #2    CB CE       Set 1,(hl)     Set left walls
                      19          Add hl,de
                      10 FB       Djnz #2
                      06 0A       Ld b,0A
                      21 8B 40    Ld hl,408b
                #3    CB C6       Set 0,(hl)     Set right walls
                      19          Add hl,de
                      10 FB       Djnz #3
                      06 0A       Ld b,0A
                      21 DC 40    Ld hl,40DC
                #4    CB D6       Set 2,(hl)     Set bottom walls
                      23          Inc hl
                      10 FB       Djnz #4
16657 (4111)          06 64       Ld b,64
                      21 82 40    Ld hl,4082      First room
'LEGALIZE'      #9    CB 46       Bit 0,(hl)      Door on right?
                      CC 2F 41    Call z 412F
                      CB 4E       Bit 1,(hl)      Door on left?
                      CC 37 41    Call z 4137
                      CB 56       Bit 2,(hl)      Door down?
                      CC 3F 41    Call z 413F
                      CB 5E       Bit 3,(hl)      Door up?
                      CC 47 41    Call z 4147
                      23          Inc hl          Next room
                      10 E9       Djnz #9
                      C9          Ret
                      00          NOP
                      11 01 00    Ld de,0001
                      19          Add hl,de
                      CB 8E       Res 1,(hl)
                      18 16       Jr #10
                      11 FF FF    Ld de,FFFF
                      19          Add hl,de
                      CB 86       Res 0,(hl)
                      18 0E       Jr #10
                      11 0A 00    Ld de,000A
                      19          Add hl,de
                      CB 9E       Res 3,(hl)
                      18 06       Jr#10
                      11 F6 FF    Ld de,FFF6
                      19          Add hl,de
                      CB 96       Res 2,(hl)
                #10   AF          XOR A
                      ED 52       Sub c hl,de
                      C9          Ret
16721 (4151)          07 03 03 04 00 00 07 03 03 04 1B  (DATA)
16732 (415C)          07 03 03 03 03 03 03 03 03 04 1B  (DATA)
16743 (4167)          82 83 83 81 00 00 82 83 83 81 1B  (DATA)
16754 (4172)          82 83 83 83 83 83 83 83 83 81 1B  (DATA)
16765 (417D)          05 76 05 76 82 76 00 76 00 76 07  (DATA)
                      76 05 76 05 1B
16781 (418D)          05 76 05 76 05 76 05 76 05 76 05  (DATA)
                      76 05 76 05 1B
16797 (419D)          85 85 81 00 00 84 85 85 1B        (DATA)
16806 (41A6)          85 85 85 85 85 85 85 85 1B        (DATA)
16815 (41AF)          B2 B4 BB AA B8 1B                 (DATA)
16821 (41B5)          A7 B4 B2 A7 B8 1B                 (DATA)
16827 (41BB)          B9 B7 AE AA B8 1B                 (DATA)
16833 (41C1)    #11   7E          Ld a,(hl)
                      FE 1B       Cp 1B
'PRINT DATA'          C8          Ret z
                      D7          Rst 10
                      23          Inc hl
                      18 F8       Jr #11
16841 (41C9)    #12   CD BB 02    Call 02 BB      Call keyscan
                      3E FF       Ld a,FF
'GET KEY'             BD          CP 1            Wait for key release
                      20 F8       Jr nz #12
                #13   CD BB 02    Call 02BB       Call keyscan
                      44          Ld b,h
                      4D          Ld c,01
                      51          Ld d,c
                      14          Inc d
                      28 F7       Jr z #13
                      CD BD 07    Call 07BD       Call key change
                      7E          Ld a,(hl)       Load a with key
                      C9          Ret
16863 (41DF)          2A 32 40    Ld hl,(4032)
                      E5          Push hl
                      CB 5E       Bit 3,(hl)      Up
'PRINT ROOM'          21 51 41    Ld hl,4151      Door data
                      28 03       Jr z #14        Jump if no door
                      21 5C 41    Ld hl,415C      Wall data
                #14   E5          Push hl
                      01 00 01    Ld bc,0100
                      CD F5 08    Call 08F5       Print at
                      E1          Pop hl
                      CD C1 41    Call 41C1       Print data
                      E1          Pop hl
                      E5          Push hl
                      CB 56       Bit 2,(hl)      Down
                      21 67 41    Ld hl,4167      Door data
                      28 03       Jr z #15        Jump if no door
                      21 72 41    Ld hl,4172      Wall data
                #15   E5          Push hl
                      01 00 0A    Ld bc 0A00
                      CD F5 08    Call 08F5       Print at
                      E1          Pop hl
                      CD C1 41    Call 41C1       Print data
                      E1          Pop hl
                      E5          Push hl
                      CB 46       Bit 0,(hl)      Right
```

(listing continued on next page)

(continued from previous page)

This is done by calling the print-scores routine at 424E. Data for this routine is stored between 41AF and 41C0, while the actual scores are stored in system variables; Spare 1 at 4021 is the number of moves made; Spare 2 a at 407B is the bombs left, and Spare 2 b at 407C is the tries made. The actual mechanics of printing the scores involve first loading the b register with 00, and then loading the c register with the actual score. When this has been done, the bc register pair contains the score, and a call is made to a ROM subroutine which conveniently prints the contents of this register pair as a decimal.

A player can move up, down, to the left, or to the right, using the arrowed cursor keys, 5, 6, 7, and 8, providing there is a door to move through. If there is no door, he has the option of using force and can blow a hole into a wall using a bomb. He does this by first pressing the A key and then the arrow key indicating the direction of blast required.

Only four bombs are available, and the number remaining is printed as part of the score. If a player thinks he is in the Zero Room, he can press the Newline key and have a try. If he is correct, a message will appear indicating such, otherwise the game continues and the tries score is incremented.

The perform-keypress module starts at location 4297, and is the longest routine of them all. Its job is to determine which key has been pressed, and act on it. Its operation is straightforward in that the accumulator is loaded with the value of the key which has been pressed, or if no key has been pressed, it waits for one, and the program works its way through the various commands available until it finds the one which matches the key press; it then executes the command and returns to the command subroutine. If it cannot find a command which matches the key press, a jump is made back to 4297, and the routine waits for another keypress before trying again.

The command subroutine calls all the program modules in sequence and increments the moves made counter. By having this routine at the end of the program, it can be seen that the game can be easily expanded by adding a few subroutines of your own. Using the upper nybble of each maze element, it would be possible, for example, to put various items of treasure, or terrible beasties, into various rooms and thus create an Adventure-style game.

To add your own subroutines, place them in the space indicated on the listing and move the command routine to a position in RAM above them. The call instructions for these routines are placed in the space indicated on the listing within the command routine. When adding calls in this manner, make sure that the jump relative byte is correctly adjusted so that it still jumps to the second call instruction, indicated by the label # 31.

To add commands is just as easy and is achieved by changing the instruction at # 32 to 20 XX 00 where XX is the number of bytes needed to jump forward to reach the beginning of your new command test. When your test is finished you must either perform a return or a jump instruction. If the key test proved positive, i.e., the player pressed the key you were checking for, and you therefore perform the required function, a return should be used to get back to the command routine.

If, however, the key test proved negative, you should use a jump instruction to return to 4297. If you are unsure of how to add a command, I suggest that you study the commands which the program already uses such as up, bomb, or try, and follow a similar pattern of construction.

Before loading the program into memory, you must make room for it by setting up a Rem statement containing 680 letter Es. To relieve boredom and frustration from this tedious task, I would recommend that it is done while the computer is in fast mode. When the Rem statement is complete, enter the hex loader program and Run it.

In response to the prompt, enter the hex digits given in the listing, two characters at a time, for example 06 FF D0 0C and so on, and follow each pair with a press of Newline. When complete, enter the Basic part of Dungeons which will overwrite the hex loader, and save the whole thing. When saved, be brave and Run it.

When you have the program working properly, here are a few tips on play: avoid using too many bombs, you may need them to break into the zero room; if a bomb does not destroy a wall, the wall must be one of the outer ones.

(listing continued from previous page)

```
                         21 9D 41   Ld hl,419D     Door data
                         28 03      Jr z #15       Jump if no door
                         21 A6 41   Ld hl,41A6     Wall data
                     #16 E5         Push hl
                         01 00 02   Ld bc,0200
                         CD F5 08   Call 08F5      Print at
                         E1         Pop hl
                         7E         Ld a,(hl)      Print right hand
                         FE 18      Cp 18          wall or door data
                         28 0F      Jr z #17
                         06 69      Ld b,69
                     #18 AF         Xor a
                         D7         Rst 10
                         10 FC      Dj nz #18
                         7E         Ld a,(hl)
                         D7         Rst 10
                         3E 76      Ld a,76
                         D7         Rst 10
                         23         Inc hl
                         C3 23 42   Jp 4223
                     #17 E1         Pop hl
                         CB 4E      Bit 1,(hl)
                         21 7D 41   Ld hl,417D     Door data
                         28 03      Jr z #19
                         21 8D 41   Ld hl,418D     Wall data
                     #19 E5         Push hl
                         01 00 02   Ld bc,0200
                         CD F5 08   Call 08F5
                         E1         Pop hl
                         CD C1 41   Call 41C1
                         C9         Ret
16974 (424E)             01 00 0F   Ld bc,0F00
                         CD F5 08   Call 080F      Print at
'PRINT SCORES'           21 AF 41   Ld hl,41AF     Data
                         CD C1 41   Call 41C1      Print string
                         06 00      Ld b,00
                         3A 21 40   Ld a,(4021)    Moves made
                         4F         Ld c,a
                         AF         Xor a
                         D7         Rst 10         Print space
                         CD 98 0A   Call 0A98      Print score as a
                         3E 76      Ld a,76        decimal
                         D7         Rst 10         Newline
                         D7         Rst 10         Newline
                         21 B5 41   Ld hl,41B5     Data
                         CD C1 41   Call 41C1      Print data
                         06 00      Ld b,00
                         3A 7B 40   Ld a,(407B)    Bombs left
                         4F         Ld c,a
                         AF         Xor a
                         D7         Rst 10
                         CD 98 0A   Call 0A98
                         3E 76      Ld a,76
                         D7         Rst 10
                         D7         Rst 10
                         21 BB 41   Ld hl,41BB     Data
                         CD C1 41   Call 41C1      Print data
                         06 00      Ld b,00
                         3A 7C 40   Ld a,(407C)    Tries made
                         4F         Ld c,a
                         AF         Xor a
                         D7         Rst 10
                         CD 98 0A   Call 0A98
                         C9         Ret
17040 (4290)             CD 97 42   Call 4297      Call 'perform
                         22 32 40   Ld (4032),hl   keypress'
                         C9         Ret            Ret to cmd
'PERFORM KPRESS'         CD C9 41   Call 41C9
                         01 0A 00   Ld bc,000A
                         2A 32 40   Ld hl,(4032)
                         FE 21      Cp 21
                         20 06      Jr nz #20
                         CB 4E      Bit 1,(hl)     Move left
                         20 02      Jr nz #20
                         2B         Dec hl
                         C9         Ret
                     #20 FE 22      Cp 22
                         20 06      Jr nz #21
                         CB 56      Bit 2,(hl)     Move down
                         20 02      Jr nz #21
                         09         Add hl,bc
                         C9         Ret
                     #21 FE 23      Cp 23
                         20 07      Jr nz #22
                         CB 5E      Bit 3,(hl)     Move up
                         20 03      Jr nz #22
                         ED 42      Sub c hl,bc
                         C9         Ret
                     #22 FE 24      Cp 24
                         20 06      Jr nz #23
                         CB 46      Bit 0,(hl)     Move right
                         20 02      Jr nz #23
                         23         Inc hl
                         C9         Ret
                     #23 FE 26      Cp 26
                         20 34      Jr nz #24
                         3A 7B 40   Ld a,(407B)    Drop bomb
                         FE 00      Cp 00
                         C8         Ret z
                         3D         Dec a
                         32 7B 40   Ld (407B),a
                         CD C9 41   Call 41C9
                         2A 32 40   Ld hl,(4032)
                         FE 21      Cp 21
                         20 04      Jr nz #25
                         CB 8E      Res 1,(hl)
                         18 06      Jr #26
                     #25 FE 22      Cp 22
                         20 04      Jr nz #27
                         CB 96      Res 2,(hl)
                     #26 18 06      Jr #28
                     #27 FE 23      Cp 23
                         20 04      Jr nz #29
                         CB 9E      Res 3,(hl)
                     #28 18 06      Jr #30
                     #29 FE 24      Cp 24
                         20 DE      Jr nz
                         CB 86      Res 0,(hl)
                     #30 E5         Push hl
```

```
            CD E6 40     Call 40E6
            E1           Pop hl
            C9           Ret
        #24 FE 76        Cp 76              "Try"
        #32 C2 97 42     Jp nz,4297
            E5           Push hl
            21 7C 40     Ld hl,407C
            34           Inc(hl)
            E1           Pop hl
            3E 82        Ld a,82
            BD           Cp 1
            C0           Ret nz
            3E 40        Ld a,40
            BC           Cp h
            C0           Ret nz
            C1           Pop bc
            C1           Pop bc
            C9           Ret
            ********************************
               Add here your own routines
17175 (4317)        CD E6 40     Call 40E6 (Perimeter)
                #31 CD DF 41     Call 41DF (Print room)
'COMMAND ROUTINE'   CD 4E 42     Call 424E (Print scores)
            ************************************************
               Here you add the calls to your own routines
            CD 90 42     Call 4290 (Keypress)
            21 21 40     Ld hl,4021
            34           Inc (hl)
            18 F1        Jr #31
HEX LOADER PROGRAM
 1 REM EEEEEEEEEEEEEE ETC
 5 FAST
 10 POKE16510,0
 20 LETX=16614
 30 INPUTA$
 40 POKEX,16*CODEA$+CODEA$(2)-476
 50 SCROLL
 60 PRINTX,A$
 70 LETX=X+1
 80 IFX=17192THENSTOP
 90 GOTO30
BASIC PROGRAM FOR DUNGEONS
 5 CLS
 10 PRINT"DUNGEONS, PLEASE WAIT WHILST THE"
 20 PRINT"MAZE IS CREATED"
 30 RAND
 40 FORI=16514T016613
 50 POKEI,INT(RND*16)
 60 NEXTI
 70 CLS
 80 RAND 16613-INT(RND*25)
 90 POKE16417,0
 100 POKE16507,4
 110 POKE16508,0
 120 LETI=USR17175
 130 PRINTAT1,14;"WELL DONE"
 140 PRINTAT4,14;"PRESS A KEY TO"
 150 PRINTAT6,14;"PLAY AGAIN"
 160 IFINKEY$<>""THENGOTO160
 170 IFINKEY$=""THENGOTO170
 180 RUN
To increase difficulty, change
 line 50 to read: POKE I,INT(RND*6)+10
```

Word processor

Nigel Langley, Weeping Cross, Stafford.

BBC

THE PROGRAM is a word processor written entirely in BBC Basic for the model B or, like mine, a model A which you have upgraded yourself, to include the printer interface and the extra 16K of DRAM. When all unnecessary spaces are removed the program will reside in less than 2K bytes.

The best mode to operate a word processor in is mode 0, as it has 80 columns, as do many printers, and has 32 lines of text of which I have used 31 for the work area.

However, in mode 0 the BBC computer holds the video data in eight bytes per character and printers will only accept ASCII codes. To overcome this problem I have set aside a section of RAM, just below the video RAM, and use this to store the ASCII code for the data on the screen.

Full screen editing is enabled by the use of *fx4,2, which makes the cursor-control keys generate numerical values. Other editing facilities are insertion and close-up, which although slow make the program a very usable tool.

The hash symbol calls insertion Proc; the double bar calls close-up Proc; and Escape calls the menu Proc.

Line 10 puts page mode on.

Line 20 alters the interlace timing, effectively moving the display down by one line upon the next mode change.

Lines 80 to 130 set up my parallel display memory and set it to &20 (spc).

PROCopt is the default PROC as set by line 220. This sets up the menu.

PROCwrite takes the code from PROCget and either dumps it on the screen, or moves into the edit modes. It is important that CHR$(&7F) (delete) is ignored as it ruins the edit operation. PROCwrite also keep the parallel video memory updated.

PROCprint carries out the control of the printer. It takes data out of the parallel video RAM one byte at a time and dumps it in the printer's buffer.

PROCinsert and PROCclose are the procedures that make the word processor so versatile. They carry out large amounts of memory management in the parallel video RAM, after which they transfer the results on to the screen.

PROCget is my universal keyboard reading procedure. It handles the cursor controls, manages the address pointer of the parallel video RAM and returns any other key values which are entered. Again this could easily be replaced by an assembler routine using OSRDCH.

PROCsave and PROCload are standard methods of loading and storing sections of memory; in this case the parallel video memory.

```
10 VDU14
20 *FX144,255
30 MODE0
40 PRINT TAB(20,10);"WORDPROCESSOR"
50 PRINT TAB(19,12);"IN B.B.C. BASIC"
60 PRINT TAB(10,15);"Written by Nigel Langley."
70 REM***c.N.C.J.LANGLEY. 7/5/82.
80 HIMEM=9000
90 W=12287
100 FOR X=HIMEM TO W
110   ?X=&20
120   NEXT X
130 X=HIMEM
140 CLS
150 PRINT TAB(15,0)"WordProcessor-top line is mode select";
160 A$=INKEY$(500)
170 PROCopt
180 GOTO 170
190 END
200 DEFPROCopt
210 LOCAL A$,A
220 ON ERROR GOTO 230
230 VDU30:PRINT SPC(78)
240 VDU30
250 PRINT TAB(15,0)"1=WRITE,2=SAVE,3=LOAD,4=PRINT ";
260 A$=GET$
270 A=EVAL A$
280 IF A>4 OR A<1 GOTO 230
290 ON A GOTO300,310,320,330
300 PROCwrite:GOTO 230
310 PROCsave:GOTO 230
320 PROCload:GOTO 230
330 PROCprint:GOTO 230
340 ENDPROC
350 DEFPROCwrite
360 VDU30:PRINT SPC(78)
370 VDU30:PRINT"  # for insertion routine.     | for close up routine."
380 *FX4,2
390 PROCget
400 IF A=&7F THEN X=X-1
410 IFA=&0D THEN VDU31,0,(VPOS+1):GOTO 460
420  IF A=&7F GOTO460
430 IF A=124 PROCclose:GOTO 480
440 IFA=35 PROCinsert:GOTO 480
450 PRINT CHR$(A);:?X=A
460 IF POS=79 AND VPOS=30 GOTO 480
470 GOTO 390
480 ENDPROC
490 DEFPROCprint
500 LOCAL A,X,Y
510 VDU30
520 PRINT SPC(78);
530 VDU30:W=12287
540 PRINT TAB(15,0)"PRINTING!"
550 VDU1,&0F,1,&0D
560  FORX=HIMEM TO W
570    Y=?X
580    VDU1,Y
590    NEXT X
600 ENDPROC
610 DEFPROCinsert
620 LOCAL A,T
630 VDU30:PRINT"INSERTION-move cursor to insertion point, then press space bar
"
640 PROCget
650 IF A<>&20 GOTO 640
660 VDU30:PRINT SPC(78);:VDU30
670 PRINT"Now enter the phrase for insertion (END WITH #), PRESS ANY KEY.";
680 A$=INKEY$(10000)
690 VDU30
700 PRINT SPC(78)
710 VDU30
720 A$=""
730 A=GET
740 PRINT CHR$(A);
750 IFA=35 OR POS=79 GOTO 780
760 A$=A$+CHR$(A)
770 GOTO 730
780 VDU30,10
790 FORT=W TO X STEP-1
800   ?(T+LENA$)=?T
810   NEXT T
820 FORT=1TO(LENA$)
830   ?(X-1+T)=ASC(MID$(A$,T,1))
840   NEXTT
850 FORT=HIMEM TO W-1
860   PRINT CHR$(?T);
870   NEXT T
880 ENDPROC
890 DEFPROCsave
900 VDU30:PRINT SPC(78):VDU30
910 PRINT"PRESS RECORD THEN RETURN."
920 VDU21
```

(continued on page 79)

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(continued from page 77)

```
 930 *SAVE"TEXT" 2650 2FFF 2650
 940 VDU6
 950 ENDPROC
 960 DEFPROCload
 970 LOCAL Z
 980 VDU30:PRINT SPC(78):VDU30
 990 PRINT"PRESS PLAY."
1000 VDU21
1010 *LOAD"TEXT"
1020 VDU6
1030 VDU31,0,1
1040 FORZ=HIMEM TO W
1050   IF ?Z=127 THEN ?Z=32
1060   PRINT CHR$(?Z);
1070   IF POS=79 AND VPOS=30 GOTO 1090
1080   NEXT Z
1090 ENDPROC
1100 DEFPROCclose
1110 LOCAL A,Z
1120 VDU30:PRINT"Position the cursor at the end of the area you are closing. TH
EN PRESS SPACE."
1130 PROCget
1140 IF A<>&20 GOTO 1130
1150 VDU30:PRINT SPC(78)
1160 VDU30:INPUT"How many spaces do you wish to close",A
1170 FOR Z=X TO W
1180   ?(Z-A)=?Z
1190   NEXT Z
1200 VDU30,10
1210 FOR Z=HIMEM TO W
1220   IF POS=79 AND VPOS=30 GOTO 1240
1230   PRINT CHR$(?Z);
1240   NEXT Z
1250 ENDPROC
1260 DEFPROCget
1270 A=GET
1280 X=POS+(VPOS-1)*80+HIMEM
1290 IF A=136 VDU31,(POS-1),VPOS:GOTO 1270
1300 IF A=137 VDU31,(POS+1),VPOS:GOTO 1270
1310 IF A=138 VDU31,POS,(VPOS+1):GOTO 1270
1320 IF A=139 VDU31,POS,(VPOS-1):GOTO 1270
1330 ENDPROC
```

Earth invader

Bharat Patel,
Oldham,
Greater Manchester.

VIC-20

EARTH INVADER runs on an unexpanded Vic-20. The game uses good colour and sound, and needs skill, quick reactions and is by no means easy.

The Vic draws a maze and then plays a tune; the maze is different every time it is run. You are a soldier who has to manoeuvre up to the fortress in the upper-left corner and break through its walls without crashing into the maze. During the adventure an Earth Invader will roam about, gradually swallowing the maze, and so making life a little easier.

Many asteroids will appear during the journey at random positions. These must be carefully avoided or you will be blown up. When you have reached the fortress you have to break in and save the lonely princess who has been so far kept hostage by the Earth Invader.

The next task of the soldier is to move on top of the Invader and by pressing f, destroy it. This will need very quick reactions. After that you will have your Earth Invader adventure. You have about one minute to accomplish this and the time will be found ticking away at the top of the screen.

To move around use the following keys: up, O; down, L; right, P; and left, I. To fire press F.

The program consists mainly of Peeks and Pokes. Line 50 switches all speakers and volume off. Line 180 changes the colour of screen to black and border to red. It clears the screen and sets the cursor colour to white. Lines 200 to 208 set up the variables and draw the fortress and the princess. Lines 290 to 500 pick random positions and print blocks on each line for the maze. Lines 505 to 612 play a tune using the Read and Data statements. Lines 700 to 775 move the soldier and produce asteroids at random positions and also register whether there has been any collision or score.

Lines 800 to 900 make a crash when a collision occurs between the soldier and the maze or an asteroid. Lines 910 to 932 give various endings depending on the state of play and the time. Lines 950 to 1200 give the changing circle effect after reaching the princess. Variable K is a test to see whether the soldier has reached home and so he can continue to run after and shoot at the invader. Lines 1200 to 4010 make various sounds and symbols when firing and when on target: lines 4000 onwards are used when time runs out, making flashes and sounds.

```
EARTH INVADER

10 REM*EARTH INVADERS**BY (BHARAT PATEL)
50 FORI=36874TO36878:POKEI,0:NEXT:POKE36879,255:K=0
55 PRINT"
56 PRINT"*****EARTH INVADERS*****"
57 PRINT"                          "
60 PRINT"  HIT SPACE TO PLAY"
70 GETS$:IFS$<>" "THEN70
90 PRINT"THANK-YOU":FORG=1TO400:NEXTG
180 PRINT"":POKE36879,10
200 P=7724:WIN=100:Y=36878
205 POKEP+5,90:POKE38444+5,4
207 POKEP-17,114:POKEP-18,114:POKEP-16,114
208 POKEP+4,107:POKEP+6,115:POKEP+26,113:POKEP+27,113:POKEP+28,113
210 REM-DRAW MAZE-
290 FORI=1TO8
300 X=INT(RND(1)*22)+1:POKE7680+X,102
330 Y=INT(RND(1)*15)+7:YY=INT(RND(1)*2)+0
340 POKEP+Y,102:POKEP+YY,102
350 CC=INT(RND(1)*15)+7:POKE7768+CC,102
360 DD=INT(RND(1)*15)+1:POKE7790+DD,102:POKE38510+DD,3
370 RT=INT(RND(1)*2)+0
380 TR=INT(RND(1)*22)+1:POKE7790+22+TR,102
390 TY=INT(RND(1)*22)+1:POKE7812+22+TY,102:POKE38554+TY,6
400 EW=INT(RND(1)*22)+1:POKE8054+EW,102:POKE8076+3+TR,102:POKE8142+DD,102
410 AW=INT(RND(1)*22)+1:POKE7856+AW,102:POKE7878+TR,102:POKE7900+BD,102
420 GJ=INT(RND(1)*22)+1:POKE7922+GJ,102:POKE7944+EW,102:POKE7966+TY,102:POKE386
86+TY,5
430 UI=INT(RND(1)*22)+1:POKE7988+UI,102:POKE8010+GJ,102:POKE38730+GJ,6
500 WE=INT(RND(1)*22)+1:POKE8076+WE,102:POKE8120+10+WE,102:POKE8142,102:NEXTI
503 REM-MUSIC-
505 POKE36878,0
510 READP
512 POKE36878,10
515 IFP=-1THEN700
520 READD
525 POKE36875,P:POKE36876,P
528 FORBK=1TOD*30:NEXTBK
530 POKE36875,0:POKE36876,0
535 GOTO510
600 DATA187,4,187,4,201,2,201,4,201,2,195,2,195,2,183,2,163,2,175,6,163,1,175,1
610 DATA183,2,195,2,195,2,201,2,195,2,183,2,163,3,175,1,183,2,175,2,175,2,163,6
612 DATA -1,-1
690 REM-*INVADER+SOLDIER*
700 H=8164+19:Z1=7910:O=7680
706 POKEH,43
707 O1=INT(RND(1)*506):IFO1=49 THEN707
708 POKEO+O1,42
709 PRINT"TIME="WIN:POKE7680+16,32
710 POKEP+5,90
711 IFPEEK(H)=90THEN950
712 POKEH,43:POKEP+5,90:POKE38444+5,4
713 POKEZ1,88:FORS1=1TO10:NEXTS1:REM-Z1=INVADER
714 Z2=INT(RND(1)*5)+1:IFZ2=2THENPOKEZ1,32:Z1=Z1-1:POKEZ1,88
715 IFZ2=3THENPOKEZ1,32:Z1=Z1+1:POKEZ1,88
716 IFZ2=4THENPOKEZ1,32:Z1=Z1+22:POKEZ1,88
717 IFZ2=1THENPOKEZ1,32:Z1=Z1-22:POKEZ1,88
718 POKE36878,10:POKE36875,190:FORI=1TO100:NEXTI:POKE36878,0
719 IFZ1>8185THENZ1=7910
720 IFZ1<7680THENZ1=7910
723 POKEH,43
724 GETA$:IFA$="I"THENPOKEH,32:H=H-1
730 IFA$="P"THENPOKEH,32:H=H+1
740 IFA$="O"THENPOKEH,32:H=H-22
742 X1=PEEK(197)
750 IFA$="L"THENPOKEH,32:H=H+22
751 IFPEEK(H)= 88ANDX1=42ANDK=1  THEN2500
752 IFX1= 42THEN2000:REM-TEST FOR FIRING
760 IFPEEK(H)=102THENPOKEH,86:POKE36878, 0:GOTO800
765 IFPEEK(H)=42THENPOKE36878,10:GOTO800
766 IFPEEK(H)=90THEN950
770 WIN=WIN-1:IFWIN=99THENPOKE7680+15,32
771 IFWIN=9THENPOKE7680+14,32:POKE7680+13,32
772 IFWIN=-1THEN4000
774 POKEH,43
775 GOTO707
800 POKEH,86:FORK=1TO10:POKE36877,10:POKE36876,190:FORI=1TO275:POKE36878,0:REM-
CRASH-
810 POKE36875,150:NEXTK:POKE36878,0:FORI=1TO1000:NEXTI
900 POKE36879,170
910 PRINT"          GAME OVER"
911 PRINT"     HARD CHEESE":PRINT"   YOU WERE KILLED":GOTO924
914 POKE36879,170:PRINT"YOU TOOK"100-WIN"SECS TO          REACH BASE":GOTO92
4
924 PRINT"......................";
925 PRINT"                      "
928 POKE198,0
929 PRINT"  ANOTHER GO":INPUTY$:IFY$="YES"ORY$="Y"THENPOKE36878,0:POKE3687
5,0
930 IFY$="Y"THENRUN
932 SYS STOP
949 REM--FIRE NOISE--
950 PRINT:POKE36878,0:POKE36878,10
1000 FORB=1TO50:POKEH,81:FORBP=1TO10:NEXTBP:POKEH,87:POKE36875,150:POKE36877,1
60
1100 POKE36878,0:POKE36878,10:POKE36875,200:NEXT
1200 K=1              POKE36878,0:GOTO711
2000 POKEZ1,88:FORS2=1TO30:POKEH,0:POKE36875,250:POKEH,87:POKEH,81:POKE36878,0
NEXTS2
2100 POKEH,32:GOTO711
2500 FORS3=1TO90:POKE36878,10:POKE36875,200:POKEH,90:POKEH,81:POKE36878,0:NEXT
GOTO914
2600 POKEZ1,32:GOTO914
4000 PRINT"          THE END  ":PRINT:PRINT"   RAN OUT OF TIME"
4001 FORSO=200TO250:POKE36879,SO:POKE36878,10:POKE36876,205:FORSA=1TO20:NEXTSA
4002  POKE36878,0:NEXTSO:POKE36879,27
4010 PRINT"  HARD CHEESE"
```

Basic renumber

R Eglin,
Hayling Island,
Hampshire.

SPECTRUM

THIS SIX-LINE program can be stored on tape and when required can be merged with current program already in the computer. All you need is the first six lines free in your program. Since most people start at line 10 you should have no problem.

My program uses the addresses of the two variables NXTLIN which is obtained from

PEEK 23637 + 256 * PEEK 23638

and program variables which is obtained from

PEEK 23627 + 256 * PEEK 23628

The former gives start address for renumbering and the latter provides the halt signal for the end of the program. To merge with your existing program already in the computer, select Merge and type "renumber", thus Merge "renumber". Start the tape, and press

(continued on page 81)

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(continued from page 79)

enter. When you have finished, List and you will see the program installed above yours. Select Run and you have renumbered your program.

You can select the first line number and the step by changing line 2, but obviously the first line must be more than 6. When you have finished renumbering, you should delete the line Save "renumber", also to prevent the renumber program working everytime you run, change the first line to read Goto 30, which will now be the first line of your program or you can of course delete the renumber program altogether after use, but if you are anything like me — always adjusting programs — you will find it useful to leave in.

```
1 Let Z = 23627 : GOTO 5 : Rem R EGLIN
  renumber Spectrum
2 For X = 20 to 9970 STEP 10 :
  IF M = Peek Z + 256 * Peek (Z + 1) then stop.
3 Poke M, Int (X/256) : Poke (X + 1), X - 256 *
  Int (X/256)
4 Let M = M + 2: let A = Peek M + 256 * Peek
  (M + 1):
  Let M = M + A + 2 : Next X
5 Let M = Peek (Z + 10) + 256 * Peek (Z + 11) :
  GOTO 2
6 Save "renumber".
```

3D triangle

D Konig,
Hexham,
Northumbria.

THIS PROGRAM will run on the BBC model A microcomputer and possibly on the model B. It simulates the random movement through three dimensions of a triangle. It can also be made to leave a trace of itself on the screen. The background and foreground colours are user-definable in accordance with the tables on page 55 of the *Provisional User Guide.* The user also has the choice of just bouncing triangles or a trace leaving a bouncing triangle.

When the program is running pressing the space bar will stop the action; pressing X will continue it; pressing C will clear the screen but continue as before; pressing E will escape from the program.

```
100 REM***3-D TRIANGLES AND PATTERNS***
110 REM****BY D.KONIG AND P.MCCOWIE****
115 REM**********(C) 14/5/1982**********
120 MODE7:FORI=1TO2:PRINTTAB(5,10+I)CHR$141"PATTERNS AND TRIANGLES":NEXT
130 B%=INKEY(500):MODE4:VDU19,1,3,0,0,0,19,2,1,0,0,0
140 PRINTTAB(1,3)"WHEN ROUTINE BEGINS PRESS:":PRINTTAB(1,5)"<SPACE> TO PAUSE."
150 PRINTTAB(1,7)"<X> TO CONTINUE.":PRINTTAB(1,9)"<E> TO END"
160 PRINTTAB(1,11)"WHICH BACKGROUND COLOUR ?":INPUTTAB(1,13)"(0-15) ",BC
170 IFBC<0ORBC>15THEN160
180 PRINTTAB(1,13);SPC(10)
190 PRINTTAB(1,11)"WHICH FOREGROUND COLOUR ?":INPUTTAB(1,13)"(0-15) ",FC
200 IFFC<0ORFC>15THEN190
210 PRINTTAB(1,11)"DO YOU WANT A PATERN OR TRIANGLE ?"
220 PRINTTAB(1,13);SPC(10):INPUTTAB(1,13)"(P-T) ",F$:IFF$="P"THENZ=1ELSEZ=2
230 MODE4:VDU19,1,FC,0,0,0,19,2,BC,0,0,0:A=RND(30):B=RND(30):C=RND(30)
240 D=RND(30):E=RND(30):F=RND(30):X1=400:Y1=400:X2=700:Y2=500:X3=500:Y3=700
250 GCOL0,1:MOVEX1,Y1:DRAWX2,Y2:DRAWX3,Y3:DRAWX1,Y1
260 A$=INKEY$(1):IFA$=" "THENPROCPAUSE
270 IFA$="C"THENCLS
280 IFA$="E"THENEND
290 IFX1>1280ORX1<0THENA=-A
300 IFX2>1280ORX2<0THENC=-C
310 IFX3>1280ORX3<0THENE=-E
320 IFY1>1024ORY1<0THENB=-B
330 IFY2>1024ORY2<0THEND=*D
340 IFY3>1024ORY3<0THENF=-F
350 MOVEX1,Y1:GCOL0,Z:DRAWX2,Y2:DRAWX3,Y3:DRAWX1,Y1
360 SOUND1,-15,X1/5,1:SOUND2,-15,X2/5,1:SOUND3,-15,X3/5,1
370 X1=X1+A:Y1=Y1+B:X2=X2+C:Y2=Y2+D:X3=X3+E:Y3=Y3+F:GOTO250
380 DEFPROCPAUSE
390 IFGET$<>"X"THEN390:*FX 15,0
400 ENDPROC
```

Permutations

David Guest,
Selly Park,
Birmingham.

MY SUBROUTINE can be used in any program that needs to use a large number of permutations, such as the recent *Your Computer* competition with six trolls in six caves.

Each permutation is individually generated so very little memory space is needed. The program was written for a Video Genie, but is easily adapted for other machines. The two short demonstration programs are to demonstrate its use and function.

```
900 REM ** PERMUTATION GENERATING SUBROUTINE
910 REM ** THE P'TH PERM OF NUMBERS 1,2,...N IS
920 REM ** GENERATED IN A(1),A(2),...A(N)
930 REM ** THE VALUE OF P IS DESTROYED IN PROCESSING
940 REM ** J,K,L,Q,R,B(1),B(2),...B(N) ARE USED AS WORK VARIABLES
950 REM ** THERE ARE N FACTORIAL POSSIBLE PERMS SO
960 REM ** P SHOULD BE IN RANGE 0 TO N!-1
970 REM ** P=0 GIVES IDENTITY PERM 1,2,...N
980 REM
990 REM ** INITIALISE A(1),A(2),...A(N)
1000 FOR J=1 TO N:A(J)=J:NEXTJ
1010 L=1
1015 REM ** START OF LOOP
1020 IF P=0 THEN RETURN
1030 IF L=N THEN RETURN
1040 L=L+1
1050 Q=P/L
1060 R=P-Q*L
1070 P=Q
1080 IF R=0 THEN 1020
1090 REM ** ROTATE L ELEMENTS R PLACES TO RIGHT
1100 FOR J=1 TO L
1110 K=J+R : IF K>L THEN K=K-L
1120 B(K)=A(J) : NEXT J
1130 REM ** COPY B INTO A
1140 FOR J=1 TO L:A(J)=B(J) :NEXTJ
1150 GOTO 1020
```

```
1 REM ** DEMONSTRATION PROGRAM 2
5 REM
10 DEFINT A-Z
20 DIM A(7),B(7)
30 INPUT N
35 IF N=0 THEN STOP
40 LIM=1: FOR J=2 TO N:LIM=LIM*J: NEXT J
50 FOR PP=0 TO LIM-1
55 P=PP
60 PRINTPP,
70 GOSUB 1000
80 FOR J=1 TO N:PRINTA(J); :NEXTJ
90 PRINT
100 NEXT PP
110 GOTO 30
1 REM ** DEMONSTRATION PROGRAM 1
5 REM
10 DEFINT A-Z
20 DIM A(7),B(7)
30 INPUT N
40 INPUT P
50 IF P < 0 THEN STOP
60 PRINT P
70 GOSUB 1000
80 FOR J=1 TO N:PRINTA(J); :NEXTJ
90 PRINT
100 GOTO 40
```

Graphics strings

Julian Stradling,
Portsmouth,
Hampshire.

THREE PROBLEMS I have always found with complicated ZX-81 graphic displays are:

- If Break is pressed, then any following command will clear the screen, losing the display.
- Changes in the display are relatively slow, and
- Changes in the display using Print At etc., are sequential — it would look far neater in many cases if the whole of the screen changed at once.

These problems are overcome to a certain extent by storing the display in a dimensioned string and by using

LET S$ (X TO Y) = "whatever"

which is slightly quicker than

PRINT AT X,Y;"whatever"

When the changes have been made, using

PRINT AT 0,0;S$

will print the whole of the display at once. The advantages of this method of screen display are illustrated in the Patience program shown.

Line 15 stores the screen in S$ — 704 characters long. If a 24-line screen were used, then this would read Dim S$(768), and a Poke 16418,0 would be inserted before the print statement in line 355. Line 3 warns that there will be a delay of anything up to 20 seconds while the machine shuffles the cards and draws the screen.

The screen display consists of seven depot piles numbered 1 to 7, each containing five cards, a foundation pile marked with an

(continued on next page)

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inverse F, and a face-down stock pile marked with an inverse S.

The bottom card of each depot pile is exposed. Any exposed card may be placed on to the top card of the foundation pile, so long as it differs from that card by one. For example, a seven may be placed on a six or an eight, but not on any other card — irrespective of suit. This is done by pressing the number, 1 to 7, of the corresponding depot pile.

Kings are high, aces are low, and neither may be placed on the other. When the patience becomes blocked, a card may be dealt from the stock pile on to the foundation pile by pressing S. This will decrease the number of cards in the stock pile by one.

You win if you manage to clear all seven depot piles. You lose if you are blocked, and have run out of stock cards. In either case, pressing S will display your score.

```
   1 SLOW
   2 PRINT AT 8,12;"[illegible]"
   3 PRINT AT 18,0;"WHEN YOU PRE
SS A KEY, THE SCREENWILL BLANK O
UT FOR ABOUT 20 SECS"
   4 PRINT AT 21,10;"[illegible]
[illegible]"
   5 IF INKEY$="" THEN GOTO 5
   6 RAND
   7 LET E=0
  10 FAST
  12 LET A$="A23456789TJQK"
  13 LET B$="SHDC"
  15 DIM S$(704)
  20 DIM C(4,13)
  25 DIM N(7)
  30 LET Z=17
  35 DIM V(17)
  37 DIM P(7,5)
  38 DIM Q(7,5)
  40 DIM W(17)
  45 FOR I=32 TO 704 STEP 32
  50 LET S$(I-31 TO I)="[illegible]
[illegible]"
  55 NEXT I
  60 FOR I=1 TO 17
  65 GOSUB 1E3
  70 LET V(I)=S
  75 LET W(I)=T
  80 LET S$(32*I+34 TO 32*I+60)=
"[illegible]"
  85 NEXT I
  90 FOR I=4 TO 13 STEP 3
  95 LET S$(32*I+2 TO 32*I+28)="
[illegible]"
 100 NEXT I
 105 FOR I=286 TO 414 STEP 32
 110 LET S$(I TO I+2)="   "
 115 LET S$(I+288 TO I+290)="[illegible]
"
 120 NEXT I
 125 FOR I=1 TO 7
 130 FOR J=1 TO 5
 135 GOSUB 1E3
 140 LET P(I,J)=S
 145 LET Q(I,J)=T
 150 LET S$(J*96+I*4-34)=A$(Q(I,
J))
 155 LET S$(J*96+I*4-2)=B$(P(I,J
))
 160 NEXT J
 165 LET N(I)=5
 170 LET S$(I*4-1)=CHR$ (156+I)
 175 LET S$(I*4+639)=CHR$ (156+I
)
 180 LET S$(576+I*4)=A$(Q(I,5))
 185 LET S$(544+I*4)=B$(P(I,5))
 190 NEXT I
 195 LET S$(255)="[illegible]"
 200 LET S$(543)="[illegible]"
 210 SLOW
 300 LET A=W(Z)
 305 LET B=V(Z)
 310 LET Z=Z-1
 315 LET S$(286)=A$(A)
 320 LET S$(416)=A$(A)
 325 LET S$(318)=B$(B)
 330 LET S$(384)=B$(B)
 350 IF INKEY$<>"" THEN GOTO 350
 355 PRINT AT 0,0;S$
 361 PRINT AT 19,30;Z
 365 LET Z$=INKEY$
 370 IF Z$="S" THEN GOTO 600
 375 IF CODE Z$>CODE "7" OR CODE
Z$<CODE "1" THEN GOTO 365
 380 LET Y=VAL Z$
 385 IF N(Y)=0 THEN GOTO 2E3
 390 IF ABS (Q(Y,N(Y))-A)<>1 THE
N GOTO 2E3
 395 PRINT AT 21,13;"..OK.."
 400 FOR I=N(Y)*3-1 TO N(Y)*3+3
 405 LET G=I*32+Y*4-2
 410 LET S$(G TO G+2)="[illegible]"
 415 NEXT I
 420 LET A=Q(Y,N(Y))
 425 LET B=P(Y,N(Y))
 430 LET N(Y)=N(Y)-1
 435 IF N(Y)=0 THEN GOTO 315
 440 FOR I=N(Y)*3+1 TO N(Y)*3+3
 450 LET G=I*32+Y*4-2
 455 LET S$(G TO G+2)="   "
 460 NEXT I
 465 LET S$(96*N(Y)+96+Y*4)=A$(Q
(Y,N(Y)))
 470 LET S$(96*N(Y)+64+Y*4)=B$(P
(Y,N(Y)))
 475 GOTO 315
 600 IF Z>0 THEN PRINT AT 21,13;
"..OK.."
 602 IF Z>0 THEN GOTO 300
 605 LET E=1
 610 GOTO 2E3
 999 STOP
1000 LET S=INT (RND*4+1)
1010 LET T=INT (RND*13+1)
1020 IF C(S,T)=1 THEN GOTO 1E3
1030 LET C(S,T)=1
1040 RETURN
2000 LET O=0
2010 FOR I=1 TO 7
2020 LET O=O+N(I)
2030 NEXT I
2040 IF O=0 THEN GOTO 2100
2050 IF Z=0 AND E=1 THEN GOTO 20
70
2060 GOTO 350
2070 PRINT AT 15,12;"HARD LUCK"
;AT 17,7;"YOU LOST BY ";O;" CARD
";
2080 IF O<>1 THEN PRINT "S"
2090 STOP
2100 PRINT AT 15,12;"WELL DONE"
;AT 17,0;"YOU WON WITH ";Z;" STO
CK CARD";
2110 IF Z<>1 THEN PRINT "S";
2120 PRINT " LEFT"
2130 STOP
```

Sharp hints

Peter Redford and Jonathan Bryant, Stockport, Cheshire.

MZ-80K

HERE IS A selection which should prove of use to MZ-80K users.

To change the computer to lower case.	POKE 4464,1
To change the computer to upper case.	POKE 4464,0
To make a program run itself when loaded — use just before saving.	POKE 10682,1
To disable the Break key.	POKE 6636,0
	POKE 8767,0
	POKE 8768,0
	POKE 8769,0
To enable the Break key.	POKE 6636,205
	POKE 8767,218
	POKE 8768,133
	POKE 8769,19
To blank out the screen.	POKE 59555,0
To restore the screen.	POKE 59555,1
To change the LED to red.	POKE 57347,4
To change the LED to green.	POKE 57347,5
To display quotations on to the screen.	POKE 6350,0
To return to normal.	POKE 6350,34
To make program line 1 into line 0.	POKE 18440,0
To make line 0 into line 1.	POKE 18440,1
To return to Basic after using the command Bye.	GOTO $1200
To return to Basic after using the command Bye. This keeps the program which was in the computer before Bye was used.	GOTO $124A

Speed ball

Michael Rigby,
Morecambe,
Lancashire.

ZX-81

THIS PROGRAM is written entirely in machine-code with two lines of Basic used to store and run the program. It can be used with only 16K as the screen must be memory-mapped.

When run, a moving ball will appear from a random position along the side of the screen. You must manoeuvre a cross, which is controlled by keys 5, 6, 7, 8 to cover the ball. The number of points gained is displayed at the bottom of the screen.

After the 354 characters have been entered, the machine-code can be stored using the following program which allows more than one code to be entered at one time.

```
10 LET A$ = ""
20 LET B = 16549
30 IF A$ = "" THEN INPUT A$
40 SCROLL
50 PRINT B; ": A$ (TO 2)
60 POKE B (CODE A$-28) * 16 + (CODE A$ (2) - 28)
70 LET B = B+1
80 LET A$ = A$ (3TO)
90 GOTO 30
```

The program is terminated by pressing Newline.

```
16549-2A 0C 40.....LD HL.(400C)
      11 D7 02.....LD DE.02D7
      19...........ADD HL.DE
      EB...........EX DE.HL
      21 82 40.....LD HL.4082
      01 09 00.....LD BC.0009
      ED B0........LDIR
      1B...........DEC DE
      ED 53 3C 40..LD (403C).DE
      E5...........PUSH HL
      21 0A 00.....LD HL.000A
      19...........ADD HL.DE
      EB...........EX DE.HL
      01 0A 00.....LD BC.000A
      E1...........POP HL
      ED B0........LDIR
      1B...........DEC DE
      ED 53 3E 40..LD (403E).DE
      3E 83........LD A.83
      CD 02 42.....CALL 4202
      0E 14........LD C.14
      3E 85........LD A.85
      D7...........RST 10
      3E 08........LD A.08
      06 1E........LD B.1E
16601-D7...........RST 10
      10 FD........DJNZ.FD
      3E 05........LD A.05
      D7...........RST 10
      0D...........DEC C
      20 F0........JR NZ.F0
      3E 03........LD A.03
      CD 02 42.....CALL 4202
      11 19 0A.....LD DE.0A19
      ED 53 41 40..LD (4041).DE
      3A 34 40.....LD A.(4034)
      CB 3F........SRL A
      06 7F........LD B.7F
      B8...........CP B
      F2 01 41.....JP P.4101
      67...........LD H.A
      78...........LD A.B
      D6 14........SUB 14
      47...........LD B.A
      7C...........LD A.H
      18 F4........JR F4
      90...........SUB B
      3C...........INC A
      57...........LD D.A
      1E 02........LD E.02
      3E 01........LD A.01
16648-BA...........CP D
      20 04........JR NZ.04
      3E 14........LD A.14
      18 07........JR 07
      3E 14........LD A.14
      BA...........CP D
      20 05........JR NZ.05
      3E 15........LD A.15
      32 2C 41.....LD (412C).A
      3E 02........LD A.02
      BB...........CP E
      20 04........JR NZ.04
      3E 1C........LD A.1C
      18 07........JR 07
      3E 1F........LD A.1F
      BB...........CP E
      20 05........JR NZ.05
      3E 1D........LD A.1D
      32 2D 41.....LD (412D).A
      14...........INC D
      1C...........INC E
      CD E5 41.....CALL 41E5
      7E...........LD A.(HL)
      FE 08........CP 08
      28 1E........JR Z.1E
      2A 3E 40.....LD HL.(403E)
      7E...........LD A.(HL)
      FE 25........CP 25
16700-28 03........JR Z.03
      34...........INC (HL)
      18 05........JR 05
      36 1C........LD (HL).1C
      2B...........DEC HL
      18 F3........JR F3
      3A 57 41.....LD A.(4157)
      FE 5B........CP 5B
      28 02........JR Z.02
      D6 05........SUB 05
      32 57 41.....LD (4157).A
      18 9A........JR 9A
      36 80........LD (HL).80
      06 00........LD B.00
      0E 0F........LD C.0F
      0D...........DEC C
      20 FD........JR NZ.FD
      10 F9........DJNZ.F9
      36 08........LD (HL).08
      ED 53 43 40..LD (4043).DE
      CD BB 02.....CALL 02BB
      7C...........LD A.H
      2F...........CPL
      95...........SUB L
      ED 5B 41 40..LD DE.(4041)
      FE 29........CP 29
      20 01........JR NZ.01
      1D...........DEC E
16756-FE 19........CP 19
      20 01........JR NZ.01
      1C...........INC E
      FE 21........CP 21
      20 01........JR NZ.01
      15...........DEC D
      FE 31........CP 31
      20 01........JR NZ.01
      14...........INC D
      7A...........LD A.D
      FE 13........CP 13
      20 01........JR NZ.01
      15...........DEC D
      FE 01........CP 01
      20 01........JR NZ.01
      14...........INC D
      7B...........LD A.E
      FE 1F........CP 1F
      20 01........JR NZ.01
      1D...........DEC E
      FE 03........CP 03
      20 01........JR NZ.01
      1C...........INC E
      CD E5 41.....CALL 41E5
      ED 53 41 40..LD (4041).DE
      37...........SCF
      11 22 00.....LD DE.0022
      ED 52........SBC HL.DE
16806-EB...........EX DE.HL
      21 95 40.....LD HL.4095
      0E 04........LD C.04
      C5...........PUSH BC
      01 04 00.....LD BC.0004
      ED B0........LDIR
      EB...........EX DE.HL
      01 1D 00.....LD BC.001D
      09...........ADD HL.BC
      EB...........EX DE:HL
      C1...........POP BC
      0D...........DEC C
      20 F0........JR NZ.F0
      ED 5B 43 40..LD DE.(4043)
      2A 3C 40.....LD HL:(403C)
      7E...........LD A.(HL)
      FE 14........CP 14
      20 10........JR NZ.10
      06 04........LD B.04
      2A 3C 40.....LD HL.(403C)
      36 1C........LD (HL).1C
      2B...........DEC HL
      10 FB........D.NZ.FB
      3E 00........LD A.00
      32 57 41.....LD (4157).A
      C9...........RET
      FE 1C........CP 1C
      28 04........JR Z.04
16860-35...........DEC (HL)
      C3 06 41.....JP 4106
      36 25........LD (HL).25
      2B...........DEC HL
      18 DE........JR DE
      26 00........LD H.00
      6A...........LD L.D
      CB 25........SLA L
      CB 25........SLA L
      CB 25........SLA L
      CB 25........SLA L
      CB 14........RL H
      CB 25........SLA L
      CB 14........RL H
      06 00........LD B.00
      4A...........LD C.D
      09...........ADD HL.BC
      4B...........LD C.E
      09...........ADD HL.BC
      ED 4B 0C 40..LD BC.(400C)
      09...........ADD HL.BC
      C9...........RET
      06 20........LD B.20
      D7...........RST 10
      10 FD........DJNZ.FD
16903-C9...........RET

1 REM TIME=2000BALLS=0000[illegible]
[illegible]-354 ZEROES
2 RAND USR 16549
```

Faster graphics

Jonathan Brazier,
London E2.

ZX-81

POTTERING ALONG on my ZX-81, I have discovered a device which speeds up moving graphics by some four or five times without venturing into the tortuous world of machine-code. It is based on the fact that any number of At instructions may be included in one Print instruction, even if the co-ordinates are identical or overlap. The program makes it clear, of course, it only works for horizontally-moving objects if you want the object's track erased as it goes. With a little ingenuity the increase in speed is well worth the extra typing.

```
  5 PRINT AT 0,0;" SLOW "
 10 FOR F=1 TO 30
 20 PRINT AT 10,F;" >"
 30 NEXT F
 35 PRINT AT 0,0;" FAST "
 40 PRINT AT 10,1;">";AT 10,1;"
 >";AT 10,2;" >";AT 10,3;" >";AT
 10,4;" >";AT 10,5;" >";AT 10,6;
" >";AT 10,7;" >";AT 10,8;" >";A
T 10,9;" >";AT 10,10;" >";AT 10,
11;" >";AT 10,12;" >";AT 10,13;"
 >";AT 10,14;" >";AT 10,15;" >";
AT 10,16;" >";AT 10,17;" >";AT 1
0,18;" >";AT 10,19;" >";AT 10,20
;" >";AT 10,21;" >";AT 10,22;" >
";AT 10,23;" >";AT 10,24;" >";AT
 10,25;" >";AT 10,26;" >";AT 10,
27;" >";AT 10,28;" >";AT 10,29;"
 >";AT 10,30;" >";
 50 GOTO 5
```

Loony lander

Roger Valentine,
Staines,
Middlesex.

PET

THIS IS the most appalling computer game ever. It combines the worst of Invaders with the worst of Breakout to create an abysmal Lunar landing-type scenario. Perhaps its only redeeming feature is that it is so incredibly difficult to gain a decent score that you quickly tire of playing it, and so might use your computer for something more useful.

It is written for a 40-column Pet, but if you really think it is worth the effort converting it to another machine, I shall explain all the screen-Pokes. There are no machine-dependent features other than the screen-mapping, apart from the few Pet cursor controls, which are also explained.

The object is to land your space-craft — or aeroplane, the graphics are so poor that it does not matter which — on a rubble-laden runway. Before you land, you must clear the runway completely by destroying the rubble with either bombs or missiles.

You have five aircraft, each with unlimited armaments, and the planes fly from left to right — they wrap-round the right-hand side of the screen — until they either hit something or land safely. Each block of rubble destroyed with a bomb scores one point. Missiles are fired horizontally and will also wrap-round the screen, so they must always destroy the next block of rubble in your flight-path.

The problem is that destroying a block of rubble with a missile scores −20 points, and you must have a total of more than 20 for the missile button to be operative. Press Space to drop a bomb, and Shift/Space to launch a missile.

The 40-column Pet has 1,000 screen positions, with 32768 the address of the top left-hand corner. The program will run on any micro with a memory-mapped display by altering the value of P in line 5 — e.g., to 7680 for the Vic — and inserting suitable values in place of the following:

- 480 to 999 in line 20: these are numbers representing approximately the bottom half of the screen.
- 500 in line 25: line 25 ensures greater density of rubble at the lower part of the display, so any number close to the lower limit of J in line 20 will do.

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- 999 in lines 85, 1030 and 2010: the number which, when added to P, represents the bottom right-hand corner of the machine's screen.

The characters Poked to the screen are, in most cases, arbitrary but as these are Pet codes and not ASCII, I will explain what they represent. Note that Vic codes are the same as Pet's:

- Lines 20 and 1010: any character to illustrate the rubble. 247 equals an inverse space.
- Line 40: five characters representing the shape of the plane. 182-PL is the number of the plane, in inverse video.
- Line 75 and elsewhere: 32 equals a space — as in ASCII.
- Line 1000: a single character bomb.
- Line 1010: any explosion pattern, ending with a space.
- Line 2020: a missile or minus sign.
- Lines 6005-6030: a more elaborate explosion pattern.

The Pet cursor controls are:

- Line 15: clear screen.
- Line 50: cursor left/space/space/home. This ensures that a single-digit number will completely over-write a dual-digit.
- Lines 6220 to 7000: Home/down/down.
- Line 7020: The R and E are in inverse.

```
5 P=32768
10 O1=41:O2=42:O3=43:O4=44:O5=45:OI=83
15 PRINT"SCORE=";:SC=0:PL=5
20 FORJ=400TO999STEP2:POKEP+J,247
25 J=J-(RND(1)*J<500)
30 NEXT
35 BF=0
40 D=P+80*(5-PL)
45 POKED+O1,91:POKED+O2,64:POKED+O3,182-PL:POKED+O4,91:POKED+O5,64
50 PRINTSC;"  ";TAB(6);
55 IFBF=0THENBP=D+OI
60 GETQ$:IFQ$=" "THENBF=1
65 IFQ$=CHR$(160)ANDSC>20THENGOSUB2000
70 IFBF=1THENGOSUB1000
75 POKED+O1,32:D=D+1
80 IFPEEK(D+O5)=247THEN6000
85 IFD+O5=P+999THEN7000
90 GOTO45
1000 POKEBP,81:BN=BP+40
1010 IFPEEK(BN)=247THENPOKEBN,42:POKEBN,163:POKEBN,42:POKEBN,32:POKEBP,32:BP=D+
OI:BF=0:SC=SC+1
1020 POKEBP,32:BP=BN
1030 IFBP>P+999THENBF=0
1040 RETURN
2000 MP=D+O5+1
2010 IFPEEK(MP)=247ORMP>P+999THEN2100
2015 IFMP>P+999THEN2100
2020 POKEMP,45
2030 POKEMP,32
2040 MP=MP+1:GOTO2010
2100 POKEMP,42:POKEMP,32:POKEMP,42:POKEMP,32
2110 SC=SC-20
2120 RETURN
6000 FORK=1TO5
6005 POKED+O1,42:POKED+O2,42:POKED+O3,42:POKED+O4,42:POKED+O5,42
6010 POKED+O2,163:POKED+O3,163:POKED+O4,163
6015 POKED+O1,163:POKED+O2,32:POKED+O3,32:POKED+O4,32:POKED+O5,163
6020 POKED+O1,42:POKED+O2,163:POKED+O3,163:POKED+O4,163:POKED+O5,42
6025 POKED+O2,42:POKED+O3,42:POKED+O4,42
6030 POKED+O1,32:POKED+O2,32:POKED+O3,32:POKED+O4,32:POKED+O5,32
6200 NEXT
6210 PL=PL-1:IFPL>0THEN35
6220 PRINT"YOU FAILED! ALL 5 PLANES LOST FOR ONLY ";SC;"POINTS!"
6230 IFSC<20THENPRINT"PATHETIC!"
6240 GOTO7020
7000 PRINT"WELL DONE! YOU LANDED PLANE NUMBER";6-PL
7010 PRINT"WITH A SCORE OF";SC
7020 PRINT"RE-RUN    END"
7030 GETQ$
7040 IFQ$="R"THENRUN
7050 IFQ$="E"THENPRINT"":END
7060 GOTO7030
```

Calculator

Malcolm Taylor,
Riyadh,
Saudi Arabia.

ZX-81

THE PROGRAM is intended for those who have a 16K ZX-81, but wish they had a printing calculator. It will keep a running total of up to 100 entries, which may be simply numeric or any of the ZX-81 keyboard maths functions.

The screen is automatically cleared when full, and the program is menu-driven to allow alteration of any line number; review of previously scrolled-off entries; clear and restart or continue.

```
 10 REM "CALCULATOR"
 15 REM "COPYRIGHT M.J.H.TAYLOR
1982"
 20 GOTO 110
 30 REM SET UP HEADINGS
 40 CLS
 50 PRINT "LN";TAB 4;"ITEM";TAB
20;"TOTAL"
 60 PRINT "
"
 70 PRINT
 80 PRINT
 90 PRINT "
"
100 RETURN
110 PRINT TAB 5;"PRINTING CALCU
LATOR"
120 PRINT TAB 5;"
"
130 PRINT
140 PRINT
150 PRINT "YOU MAY ENTER ANY MA
THEMATICAL","FUNCTION. REVIEW FR
OM ANY LINE","BY ENTERING ""R"".
 CLEAR ALL","ENTRIES BY ENTERING
""S"". ALTER","ANY LINE BY ENTE
RING ""A""."
160 PRINT
170 PRINT "PRESS ""NEW LINE"" T
O START"
180 INPUT A$
190 GOSUB 40
200 REM SET UP FOR MAX 100 ENTR
IES
210 DIM B$(100,12)
220 DIM C(100)
230 FOR I=1 TO 100
240 GOTO 800
250 LET B$(I)=R$
260 REM SPECIAL CONDITION FOR
COUNT NUMBER ONE
270 IF I=1 THEN LET C(I)=VAL B$
(I)
280 IF I=1 THEN GOTO 300
290 LET C(I)=C(I-1)+VAL B$(I)
300 PRINT I;TAB 4;B$(I);TAB 20;
C(I)
310 REM LIMIT NUMBER OF ENTRIES
PER PAGE TO 12
320 IF I/12=INT (I/12) THEN GOS
UB 40
330 IF I/12=INT (I/12) THEN PRI
NT AT 5,0;I;AT 5,4;B$(I);AT 5,20
;C(I)
340 NEXT I
350 PRINT
360 PRINT AT 2,0;"WHICH LINE DO
YOU WISH TO ALTER?"
370 INPUT D
380 IF D>I THEN GOTO 310
390 PRINT AT 3,0;"ENTER NEW VAL
UE OF LINE ";D;"   "
400 INPUT F$
410 LET B$(D)=F$
420 GOSUB 40
430 IF D=I-1 THEN LET C(D)=C(D-
1)+VAL F$
440 IF D=I-1 THEN GOTO 550
450 FOR G=D TO (I-1)
460 IF G=1 THEN LET C(G)=VAL B$
(G)
470 IF G=1 THEN GOTO 520
480 LET C(G)=VAL B$(G)+C(G-1)
490 REM LIMIT NUMBER OF ENTRIES
PER PAGE TO 10
500 IF G>=I-10 THEN GOTO 520
510 GOTO 530
520 PRINT G;TAB 4;B$(G);TAB 20;
C(G)
530 NEXT G
540 GOTO 560
550 PRINT D;TAB 4;B$(D);TAB 20;
C(D)
560 PRINT
570 PRINT
580 GOTO 750
590 PRINT AT 2,0;"FROM WHICH LI
NE NUMBER?"
600 INPUT D
610 GOSUB 40
620 LET T=(I-D-1)
630 IF T>10 THEN LET T=10
640 FOR J=0 TO T
650 PRINT D+J;TAB 4;B$(D+J);TAB
20;C(D+J)
660 NEXT J
670 PRINT
680 PRINT
690 GOTO 750
700 GOSUB 40
710 LET I=I-1
720 PRINT I;TAB 4;B$(I);TAB 20;
C(I)
730 GOTO 340
740 REM SET UP CUES
750 PRINT AT 18,0;"ENTER ""C""
TO CONTINUE"
760 PRINT "ENTER ""S"" TO CLEAR
ALL ENTRIES"
770 PRINT "ENTER ""A"" TO ALTER
ANY LINE"
780 PRINT "ENTER ""R"" TO REVIE
W"
790 REM SET UP RESPONSE TO CUES
800 INPUT R$
810 IF R$="C" THEN GOTO 700
820 IF R$="S" THEN GOTO 190
830 IF R$="A" THEN GOTO 360
840 IF R$="R" THEN GOTO 590
850 GOTO 250
860 STOP
870 SAVE "CALCULATOR"
880 GOTO 1
```

Board-game

N D Willink,
Exeter, Devon.

ZX-81

FOR THOSE interested in how the ZX-81 can play games other than chess or draughts, this 16K program will be of some interest.

The rule of the game is that no fruit of the same kind can be in an adjacent square.

```
  2 LET S=0
  5 LET GO=0
 10 LET K$="           "
 20 FOR N=5 TO 15
 30 PRINT AT N,8;K$
 40 NEXT N
 50 DIM A(7,7)
 60 FOR N=2 TO 6
 70 FOR M=2 TO 6
 75 LET A(M,N)=3
 80 PRINT AT 2*M+2,2*N+5;" "
 85 NEXT M
 90 NEXT N
100 FOR N=1 TO 5
110 PRINT AT 2*N+4,7;N
120 PRINT AT 4,2*N+7;N
130 NEXT N
140 PRINT AT 21,0;"IN AUTOPLAY
?"
150 INPUT B$
160 IF B$(1)="Y" THEN LET S=1
170 PRINT AT 21,0;"DO YOU WANT
TO PLAY FIRST?"
180 INPUT D$
185 PRINT AT 21,0;"
"
190 IF D$(1)="N" THEN GOTO 500
200 INPUT A$
201 LET K=0
201 LET K=0
205 LET GO=GO+1
207 PRINT AT 21,0;"
"
208 PRINT AT 17,10;"TURN=";GO
210 LET V=VAL A$(1)+1
215 LET V2=VAL A$(2)+1
220 IF A(V,V2)=3 THEN GOTO 300
225 PRINT AT 21,0;"INVALID MOVE
"
230 GOTO 200
300 PRINT AT 21,0;"ORANGE OR AP
PLE"
310 INPUT C$
315 PRINT AT 21,0;"
"
320 IF C$(1)="O" THEN LET X=1
325 IF C$(1)="A" THEN LET X=2
330 IF A(V+1,V2)=X OR A(V,V2+1)
=X OR A(V-1,V2)=X OR A(V,V2-1)=X
 THEN GOTO 340
335 GOTO 400
400 LET A(V,V2)=X
402 IF X=1 THEN PRINT AT 2*V+2,
2*V2+5;"O"
410 IF X=2 THEN PRINT AT 2*V+2,
2*V2+5;"A"
500 LET Z=INT (RND*2)+1
502 LET M=INT (RND*4)+2
503 LET N=INT (RND*4)+2
507 IF A(M,N)=3 AND (A(M+1,N)<>
Z AND A(M-1,N)<>Z AND A(M,N+1)<>
Z AND A(M,N-1)<>Z) THEN GOTO 600
510 FOR M=2 TO 6
515 FOR N=2 TO 6
520 IF A(M,N)=3 AND (A(M+1,N)<>
Z AND A(M-1,N)<>Z AND A(M,N+1)<>
Z AND A(M,N-1)<>Z) THEN GOTO 600
530 NEXT N
540 NEXT M
545 LET K=K+1
547 IF K=10 THEN GOTO 700
550 GOTO 500
610 IF Z=1 THEN PRINT AT 2*M+2,
N*2+5;"O"
620 IF Z=2 THEN PRINT AT 2*M+2,
N*2+5;"A"
625 LET A(M,N)=Z
630 IF S=1 THEN GOTO 500
640 GOTO 200
700 PRINT AT 21,0;"I GIVE UP YO
YOU WIN
```

No question

Tim Miller,
Appleby-in-Westmorland,
Cumbria.

ATOM

THIS SHORT routine is written in Atom Basic and overcomes the problem of the sometimes misleading question mark which is generated by Basic's Input statement. A response such as "Enter amount :" is much more suitable than "Enter amount ?".

When the Atom encounters the word Input, it first jumps to a subroutine in the operating system to print out a prompt. The address of this subroutine is determined by the contents of addresses #209 and #208 as a 16-bit address.

All this program does is alter these addresses to a free area of memory at #80 in RAM where a machine-code routine replaces the original values of #209 and #208 and jumps back to the Input routine without printing a prompt. This in effect means that the last character printed in Basic becomes the prompt.

Although the program is simple, it is handy because of its length. The more complicated method of achieving this, which Acorn gives, is not only more than twice as long but uses three more of the precious 26 Atom variables.

```
10 REM * SUBROUTINE TO REMOVE INPUT
   PROMPT
20 P=#80;[LDA@82;STA#208;LDA@254;
   STA#209;RTS;];Z=#FE940080
30 REM * DEMONSTRATE USE
40 PRINT "ENTER AMOUNT :";!#208=Z;
   INPUT A
50 END
```

Sounds of alarm

David Harmes and David Martin,
Chesterfield,
Derbyshire.

VIC-20

THIS IS A basic program for an alarm clock for the Vic-20 with 3.5K. It starts by asking you when the alarm should sound — TI$ is a 24-hour clock. Then you must enter the time at which the clock should start. The information is then displayed on the screen.

In lines 34 and 330 in the inverted commas — "f1" and "f7" — just press the corresponding function key. Press "f1" to switch the alarm off when the alarm is rung. Press "f7" when the alarm is not on to change the setting of the alarm. Note that 2.35 am should be entered in the form: 023500.

```
1 PRINT"⊐"
3 PRINTCHR$(5)
4 POKE36879,8:GOSUB100
10 INPUT"▓▓▓CORRECT TIME ";TI$
20 PRINT"⊐"
25 PRINT"▓▓▓TIME"
30 PRINT"⊐▓▓▓▓▓▓▓";LEFT$(TI$,2);":";MID$(TI$,3,2);":";RIGHT$(TI$,2)
31 PRINT"▓▓▓ALARM"
33 PRINT"⊐▓▓▓▓▓▓▓";LEFT$(AL$,2);":";MID$(TI$,3,2);":";RIGHT$(TI$,2)
34 GETA$:IFA$="F7"THENGOSUB400
36 IFAL$=TI$THENGOSUB200
40 PRINT"▓▓▓▓▓▓VIC ALARM"
110 INPUT"▓▓▓▓▓ALARM TIME ";AL$
120 RETURN
200 POKE36878,15
210 PRINT"⊐"
220 POKE36874,250:FORN=0TO500:NEXTN
320 POKE36874,0:FORN=0TO500:NEXTN
330 GETA$:IFA$="F1"THENPOKE36878,0:RETURN
340 GOTO220
400 PRINT"⊐"
410 INPUT"ALARM TIME ";AL$
420 PRINT"⊐":RETURN
```

Search and replace

Darren Ilston,
Stockport,
Cheshire.

ZX-81

SEARCH AND replace will search the screen for a character you specify and replace it with any other. Load this machine-code routine into a Rem Statement no shorter than 23 bytes long. Search and replace runs in a 16K ZX-81 only.

Z-80 assembly listing	*Hexadecimal dump*
LD HL, (D.FILE).	2A 0C 40.
LD B, 24d.	06 19.
DEC HL.	2B.
INC HL.	23.
LD A, (HL).	7E.
CP 118.	FE 76.
JRNZ, + 3.	20 03.
DJNZ - 8.	10 F8.
RET.	C9.
CP CHR.$ (n).	FE CHR.$ (n).
JRNZ - 13.	20 F3.
LD, (HL), CHR.$ (x).	36 CHR.$ (x).
JR - 17.	18 EF.

If this machine-code routine is loaded into a Rem statement, then Poking the values:

16530, CHR.$, (n)

where CHR.$ (n) means the character to be searched for.

16534, CHR.$, (x)

where CHR.$ (x) means the character to be replaced.

Test timer

J Laidlaw, Aberdeen.

MZ-80K

I WROTE THIS program to make use of the fact that the MZ-80K's internal clock can be Poked to count to an accuracy of one-sixtieth of a second although, unfortunately, the hour count is lost and the minute count's maximum is 24. The program is short, occupying approximately 0.7K, and will run on all MZ-80Ks whatever the memory size.

```
10  X=4465:Y=4466:REM cursor positions
20  PRINT"▓Reaction timer -hit a key"
30  GET A$:IF A$="" GOTO 30
40  TI$="000000":REM set clock to zero
50  FOR Z=1 TO 3
60  READ A,B:REM alter clock to count
70  POKE A,B:REM to 1/60 of a sec.
80  NEXT Z
90  PRINT"▓"
100 FOR Z=1 TO INT(RND(1)*2000):NEXT Z
110 POKE A,B:REM start clock
120 POKE 53248+Z/2,109:REM display
130 GET A$:IF A$="" GOTO 130
140 A$=TI$:REM time taken to react
150 POKE X,8:POKE Y,20
160 PRINT"Your time - ",LEFT$(A$,2);
170 PRINT":";MID$(A$,3,2);
180 PRINT":";RIGHT$(A$,2)
190 POKE X,11:PRINT"Continue? (Y/N)"
200 GET A$
210 REM restore data and resume
220 IF A$="Y" THEN RESTORE:GOTO 40
230 REM return clock to normal and end
240 IF A$="N" THEN TI$="000000":END
250 GOTO 200
260 DATA 57351,116,57359,9,57349,2
```

Micro maestro?

J P Mcgowan,
Huddersfield,
West Yorkshire.

ZX-81

THIS PROGRAM produces "music" on your ZX-81. I am not absolutely sure how it works, but when the computer changes from fast mode to slow and vice versa, it makes a click in the cassette output port. If an amplifier is attached the oscillations can be heard. If you are without an amplifier you could use a tape recorder to tape it and then play it back.

For a lower note you can add the following lines:

```
15 REM
25 REM
```

Here is the main program listing:

```
10 FAST
20 SLOW
30 RUN
```

Words of wisdom

F K Carver,
Plymouth,
Devon.

ATOM

THIS PROGRAM is a very simple and easy-to-use substitute for a proper word processor and can be used by anyone who can use the Atom editing facilities. It is important that the first three lines are typed in exactly as shown.

To use the program, input your text anywhere after line 3 and it can be edited, added to, and so on, by using the standard Atom editing function. To print, type Control-B then run the program.

```
1I=?18*256+#46;DODO
2P.$?I;I=I+1;U.?I=13
3P.';I=I+3;U.I)=TOP;E.
4
5 FKC ATOM 'CHEAP WORDPRO'
6 ======================
7
8 TO USE PUT YOUR OWN TEXT
9 ANYWHERE AFTER LINE 3 AND IT
10 CAN BE EDITED,ADDED TO ETC.
11 BY USING THE STANDARD ATOM
12 EDITING FUNCTIONS.
13
14 TO PRINT TYPE CONTROL-B THEN
15 RUN THE PROGRAM ABOVE
```

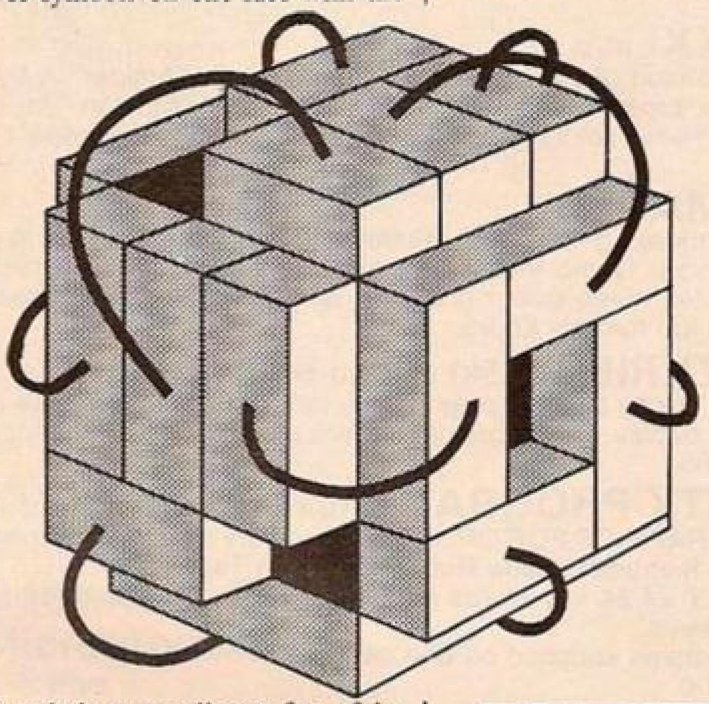
■

POWER CUBE

BY ANTHONY ROBERTS

AMONG THE Klingon's treasures that you so cleverly won in our competition in April, is a puzzling little cube which could provide fabulous amounts of free energy should you just be able to connect it up correctly.

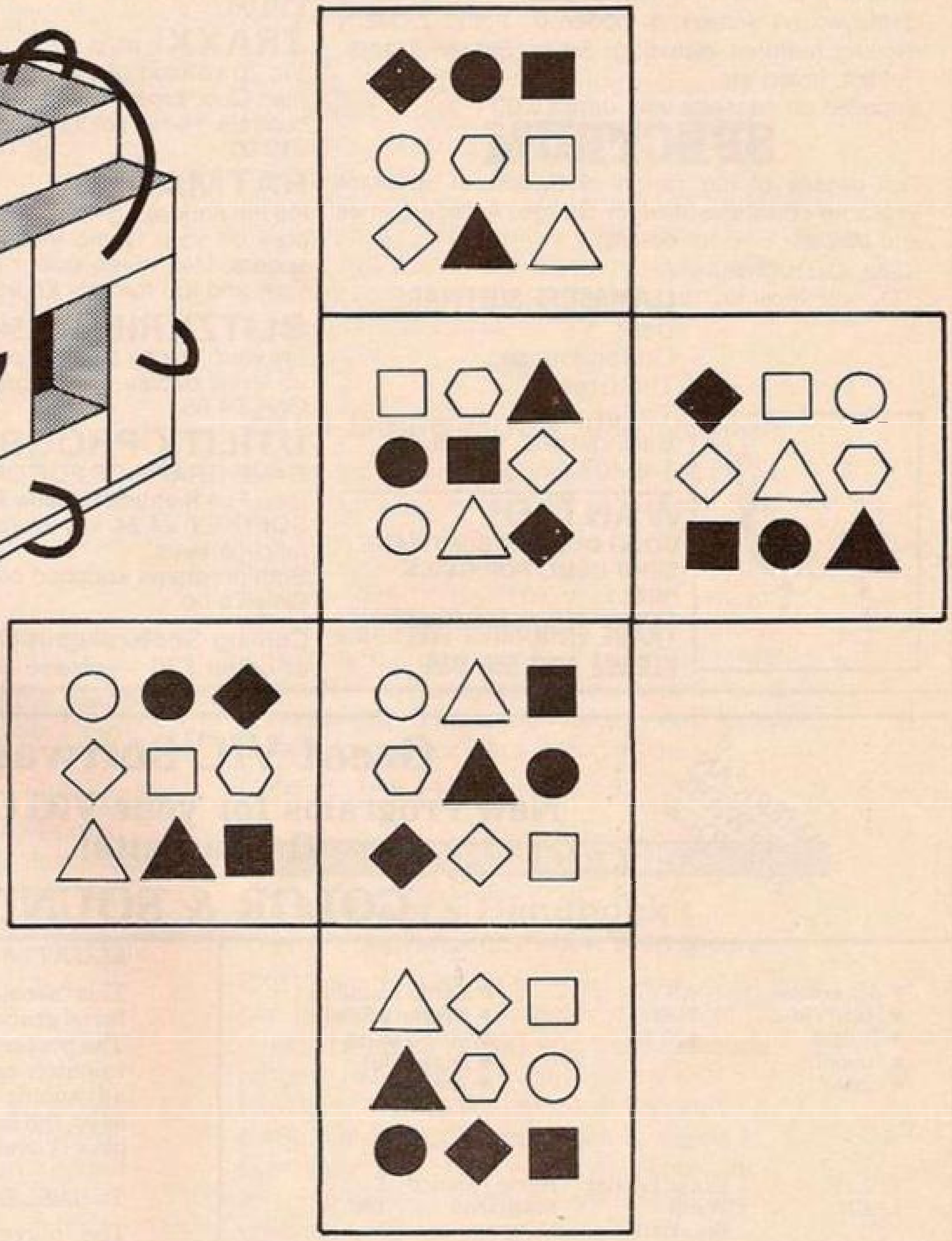
There are 12 connectors, each of which connects a pair of symbols on one face with the same pair of symbols on an adjacent face of the cube — as the picture shows. When they are all in place, one symbol is left exposed on each face — and if it is not the same symbol left on every face of the cube, you will have short-circuited it and the resulting explosion will destroy everything for miles.



Here is the unfolded plan of the cube. What symbol should be left?

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in August. The name of the winner, the solution, and a competition report will be published in the October issue of *Your Computer.*

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

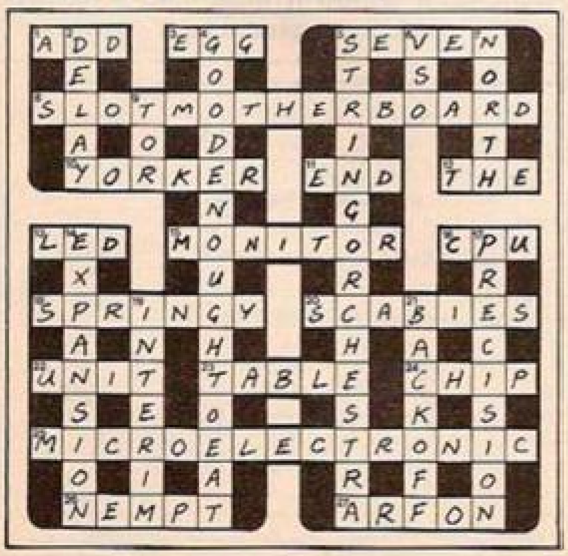


Competition results

THE NUMBER OF correct entries for the Vic expansion system competition in June made the choice of a winner as hard as ever. We finally awarded the Arfon motherboard to J W Brawn of Highfield, Willow Lane, Goxhill, South Humberside, for his "One good Vic deserves a mother".

Several other competitors felt that their Vics suffered from maternal deprivation. As Matthew Lewis explained "Vic needs mother — bored without her", while, on a different tack, Jane Finlatson revealed that "My children are bored with their mother and want to expand".

Solution to the June crossword.



Some puns were more groan-provoking than others. John Keogh claimed "I Arfon got a good memory" and J Williams expressed the Vic owner's plight with "A Vic's 'arf off without an Arfon". Others that caught the eye were R White's "Such inflation becomes stimulation without aggravation" and Sue Dealler's sinister "VICious micros have more byte".

The Golden Nugget problem attracted comparatively few entries. If you noticed that the number of nuggests collected on leaving the park is the cube of the number of trips through the park, it was easy to arrive at a solution without a computer: the answer, 32, is the cube root of the final number of nuggets collected. Programming for a solution is straightforward once you have worked out a formula for the number of pearls collected from the island on each trip through the park.

Several programs found the simplest line, using only three variables. Since the number of coins used and the number of bags is the same, a single variable can serve for both.

The winning solution drawn from the hat was sent in by Peter Hall of 10 Spean Drive, Aspley Hall, Nottingham:

```
10 LET B = 0
20 LET N = 0
30 LET B = B + 1
40 LET P = B * (B - 1)
50 LET N = N + 3*P + 1
60 IF N = 32768 THEN GOTO 80
70 GOTO 30
80 PRINT B; "COINS"
```

B = number of bags; N = number of nuggets; P = number of pearls. ■



COMPUTER NEWS

JUNE PUBLICATIONS

Beginner's Guide to BASIC Programming
A P Stephenson

Written with two primary purposes. First, many people wish to understand and make use of the exciting new technology that is now becoming available to the man in the street, but have no previous knowledge or experience. Second, there is need for a book that explains BASIC as used on microcomputers.

Since computer programming is best learnt by 'doing', the book encourages the reader to write his own programs rather than slavishly copy out other people's 'masterpieces'.

0 408 01184 X 160 pages £3.95

Beginner's Guide to Microprocessors
E A Parr

- A down-to-earth and factual treatment of how microprocessors work.
- A beginner's book suitable for the reader with an interest in microprocessors but with little previous knowledge.

Avoiding the sensational aspects of the subject that have been a feature of so many books, Andrew Parr gets down to fundamentals. After an introduction to computers in general he explains in detail how the microprocessor works, its software and programming, and how it is integrated with peripherals to form a complete microcomputer system.

Later chapters describe applications of microprocessors in control systems, robots, small business computer systems, etc. There is also a survey of microprocessor families (Z80, 8080, 6800 and 6502), and an appendix covers the various number systems used in microprocessor work.

0 408 00579 3 224 pages £3.95

26 BASIC Programs for your Micro **Derrick Daines**

A collection of 26 new and varied games programs, from spelling tests to submarine-hunting. They are graded from the most elementary, usable on the simplest home computer, to longer and more complex programs suitable for more advanced machines. Derrick Daines has written the programs in an easy subset of BASIC and lists the variables and memory size required and a sample run so that the reader should have little difficulty in modifying them for any suitable microcomputer.

0 408 01204 8 128 pages £4.95

ZX81 Basic Book **Robin Norman**

Covers the basic 1K version, the additional facilities offered by the 16K expansion RAM and how to use the Sinclair ZX printer. There are 14 original programs for you to run on the machine (for 1K and 16K versions), and for those confused by computer jargon (and who isn't?) there is a glossary of technical terms. Robin Norman assumes no initial knowledge of computing and his undemanding writing style is perfect for a beginner's introduction.

0 408 01178 5 176 pages £4.95

JULY PUBLICATIONS

ZX81 User's Handbook
Trevor J Terrell and Robert J Simpson

ZX81 owners wishing to learn more about their computer will want this book. It answers many questions about BASIC and machine code programming, and it explains the ZX81 hardware and how it operates. Programs in BASIC and machine code are included, to illustrate many of the points covered in the text and to help readers develop their own programs.

0 408 01223 4 144 pages £4.95

ORDER NOW from your local bookseller or in case of difficulty from the publisher

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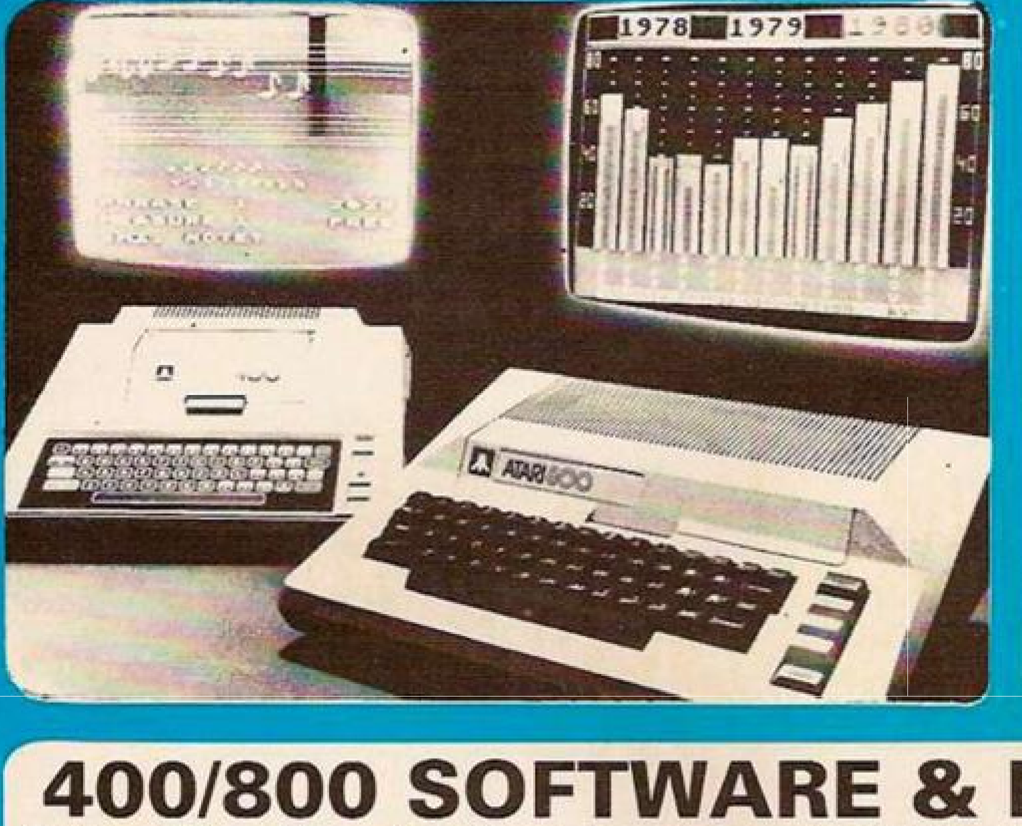
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Her: "***++**??!!***@XX??££**??!!? off!"

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You: "No, I'm not being selfish. Computers are for the whole family - and they're going to play a big part in the children's future."

Her: "Oh?"

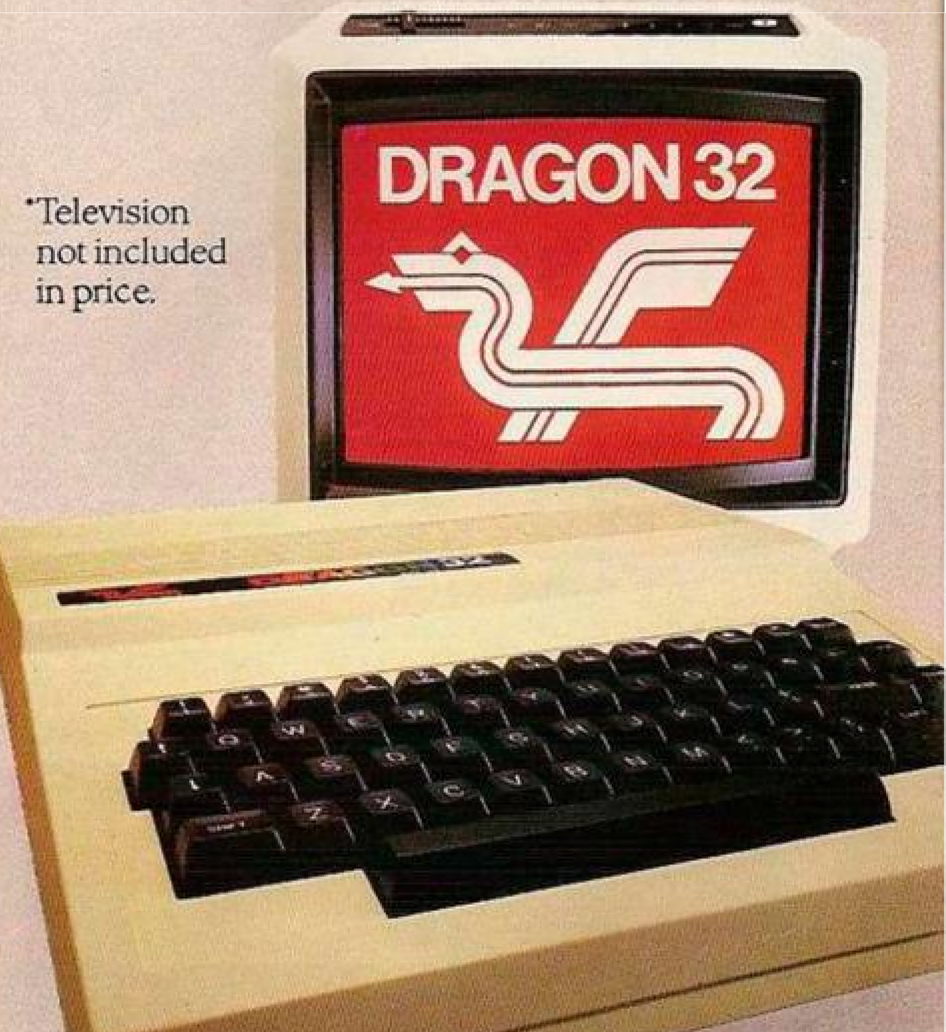
From this point on, the conversation should follow more reasonable lines. Allowing you to fully explain the many advantages of the new Dragon 32 family computer.

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For a start, the Dragon offers 32K RAM. Your wife may not understand that, so just tell her that the Dragon's capabilities are truly massive - at least twice as powerful as its competitors, with some features you won't find even in more expensive units. The Dragon will give you all the power you're likely to need, and more, to create your own programs - along with an exciting range of software which can do anything from helping with kids' spelling and arithmetic to creating your own cartoons.

THE FIRST FAMILY COMPUTER.

All of which brings you nicely to the point where you tell your wife just how much fun the kids will have with the Dragon. How it will save her all that



*Television not included in price.

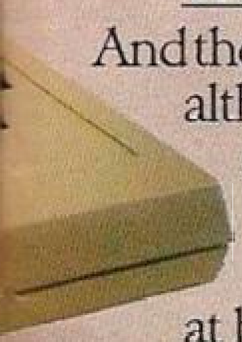
money on those Space Invader machines. How it will magically translate simple typed instructions into beautiful drawings and designs using set, line, circle, draw, scale, rotate and paint features, in up to 9 colours - and play and compose

to your wife.

SPECIFICATIONS
6809E MICROPROCESSOR. Pet, Apple, Atari 400, BBC Micro, and VIC 20 still have the less powerful 6502.
32K RAM (as standard). At least twice the power of similarly priced machines. Expandable to 64K RAM.
EXTENDED MICROSOFT COLOUR BASIC (as standard). Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using). ADVANCED SOUND 5 octaves, 255 tones. AUTOMATIC CASSETTE RECORDER CONTROL. FULL EDITING with INSERT and DELETE.
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PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions.
PRINTER (Centronics parallel).
JOYSTICK CONTROL PORTS.

with 5 octaves of music. How it will engross your children in mind-boggling adventures in dungeons and caves without even getting their knees dirty. And the Dragon works with any U.H.F. TV.

THEY'LL LEARN AS THEY PLAY.



And then you can casually point out that although the kids are having fun, they're also learning. And within a very short space of time, the whole family will be completely at home with programming – with computer language – with every aspect of how computers work. Which can't do their future prospects any harm at all.

BRILLIANTLY SIMPLE INSTRUCTION MANUAL.

The Dragon is made in Britain, designed with the help of British Universities. And it's also worth remembering that the Dragon's instruction manual is clearer and easier to understand than any other home computer's.



That its top-quality keyboard is as easy to use as a typewriter, and so well made it's guaranteed for twenty million depressions.

TAKE THE FAMILY DOWN THE HIGH STREET.

And if she still wants to know more, take her to see the Dragon 32. It'll soon be available in most good stores – or you can send the coupon for further details.

And if you're one of our many lady readers, please accept our apologies.

Perhaps you'd like to read this ad to your husband.

DRAGON 32

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To: Jean Webster, Dragon Data Ltd., Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.
Tel: 0792 580651.

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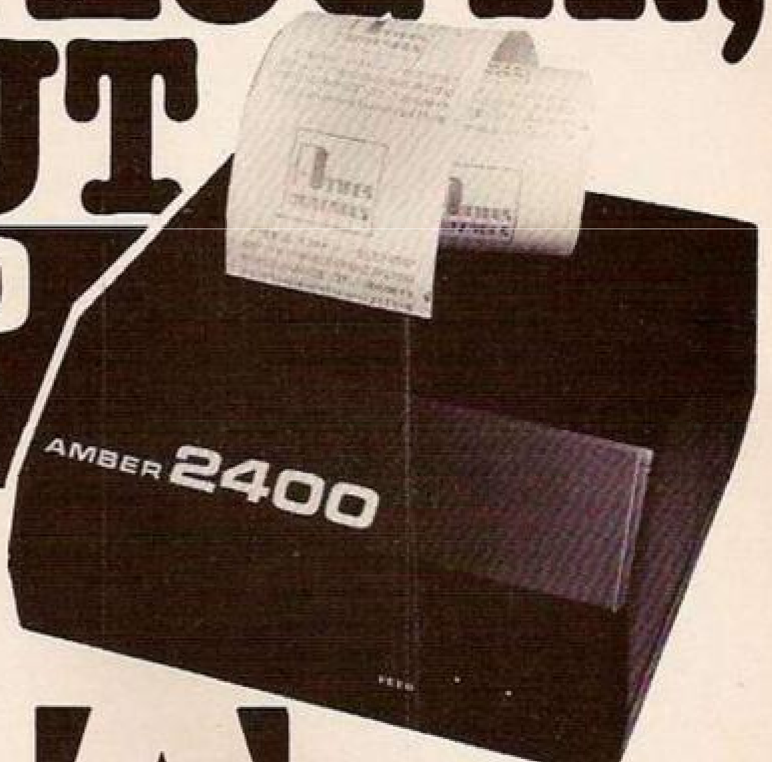
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ZX81 Organic Micro

What do you do when you want to make your micro more powerful?
You add memory. Memory is the most expensive part of a microcomputer. For example, to increase a ZX81 from 1K to 16K of RAM costs over 70% the price of the micro itself. The rest of the cost is shared between the CPU, ROM, the circuit board, the case, the keyboard, the various plugs and sockets, as well as the manufacturing and marketing expenses.

What do you do when you grow out of your ZX81, ATOM or VIC?
Throw them away or give them to your kid, and buy a more powerful machine. All you really wanted was a new CPU and a new ROM, probably the least expensive bits of integrated electronics, and yet you have normally to replace everything. One way of tackling this redundancy problem is to have a system which uses a universal bus, such as the S100. The major cost of this type of mother board system is a big case full of sockets, and a large fan-cooled power supply to cope with future expansion. The case alone will cost more than, for example, a VIC or ATOM. Although such a system allows some versatility in plugging in various boards ranging from CPU to disc controller, and allows upgrading of the computer, it is fundamentally limited by both the finite number of expansion slots and the large initial outlay.

What is so different about ORGANIC MICRO?
ORGANIC MICRO is a new concept in the packaging and organisation of a microcomputer. It relieves you of all the constraints on expansion and upgrading.

IT GROWS WITH YOU.
It consists of a family of modular units, each housed in an identical case, carefully designed to be both stylish and functional. Each unit can be equipped with different internal circuitry to perform respectively different functions. Each carries its own physical and electrical connections so that units can be connected into a linked multifunctional assembly which can be readily modified or extended. In this way a microcomputer can grow from a simple starter system into a fully fledged machine as your needs evolve. The system will always be smartly packaged at each stage of its expansion because of the way the identically packaged modules interlock. Specific requirements can be met by adding a new unit, and the CPU module can be replaced when necessary, instantly creating a new and more powerful upgraded microcomputer. The old CPU could be used as the heart of another system, there is no reason to throw it away.

ORGANIC MICRO will serve you forever.

AVAILABLE NOW - modules to turn your ZX81 into an Organic Micro.

PERSONA — This module is the basis on which the system grows. It buffers in all the signals from the ZX81 expansion port via a 44-way ribbon connector. It then talks to other modules via a 64-way ORGANIC BUS configured so that it fits onto the given ZX81 Memory Address Map. Up to 4 Mbytes of the addressable positions are allowed, all signals for dynamic memory operation are generated on board. Other modules respond when PERSONA sends their individual SLOT signal along the bus. A generous + / - 5 volt regulated DC supply powers all the modules. **£24.95**

MINIMAP — This extends the 64K of the ZX81 address space up to a possible 1 Mbyte. The space is organised into vertical 64K PAGES divided into SEGMENTS labelled FILE A, FILE B, ROM, TOOL, DATA, PATH and SLOT. Up to 16 horizontal PAGES can be supported. All this memory can be defined dynamically from within a program, allowing, for example, a program in a FILE SEGMENT to manipulate the contents of DATA SEGMENTS. **£29.95**

RAM 08 — This low-cost basic memory module has 2K of memory expandable up to 8K simply by plugging in extra RAM chips in the vacant sockets. It is located in a region of address space not used by BASIC programs and is ideal for data or machine-coded routines which might be shared by several programs. **£19.95**

RAM 16 — The remarkably low cost of this memory expansion module demonstrates the economy achieved by generating all signals necessary to operate the dynamic memories from PERSONA. On-board address decoding permits the simultaneous use of many RAM 16 modules. In common with all the memory modules it can be enabled/disabled under the control of an external signal. **£21.95**

RAM 64 — Providing 64K of memory expansion arranged as four blocks of 16K all of which can be used simultaneously (unlike other available 64K add-on) under the control of MINIMAP. **£64.95**

DROM — This sophisticated and useful module is a non-volatile memory of 2K expandable to 8K. This is achieved using ultra low power CMOS static memory in conjunction with a Nickel-Cadmium battery, which is continuously recharged during normal operation. An invaluable module, especially for saving programs under development, or often-used routines or data, making tedious cassette reloading and saving unnecessary. Individual 2K blocks can be protected against accidental overwriting. **£32.95**

TOOLKIT — Up to four 2K EPROMS can be used in this module, which are located in address space after the ZX81 on-board ROM. This allows the calling of TOOLKIT-held routines using the USR function. Since they can be individually enabled/disabled, several TOOLKIT modules can be used under MINIMAP control. **£17.95**

PERICON—a — General purpose peripheral interface providing 24 lines of Input/Output. Up to four such modules can be simultaneously used allowing basic I/O, strobed I/O, and bidirectional 8 bit data transfer with handshakes. **£22.95**

PERICON—b — For access and control of the outside world. The 24 lines are capable of directly operating relays or diving long signal lines. On-board address decoding allows the simultaneous use of up to four such modules. **£27.95**

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ZX99

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● SPECIAL FEATURES

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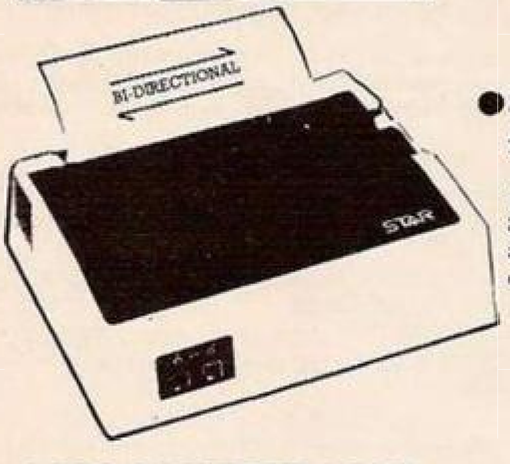
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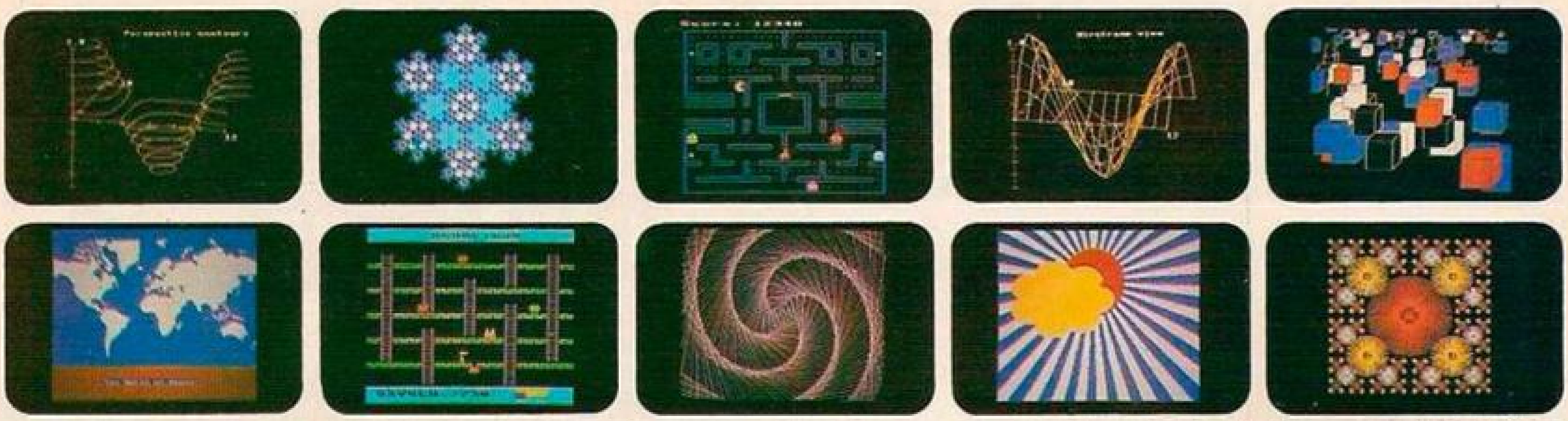
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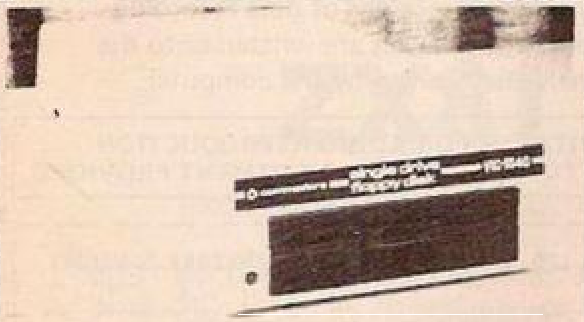
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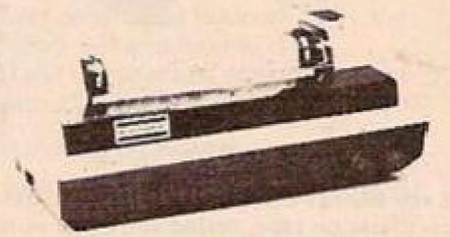
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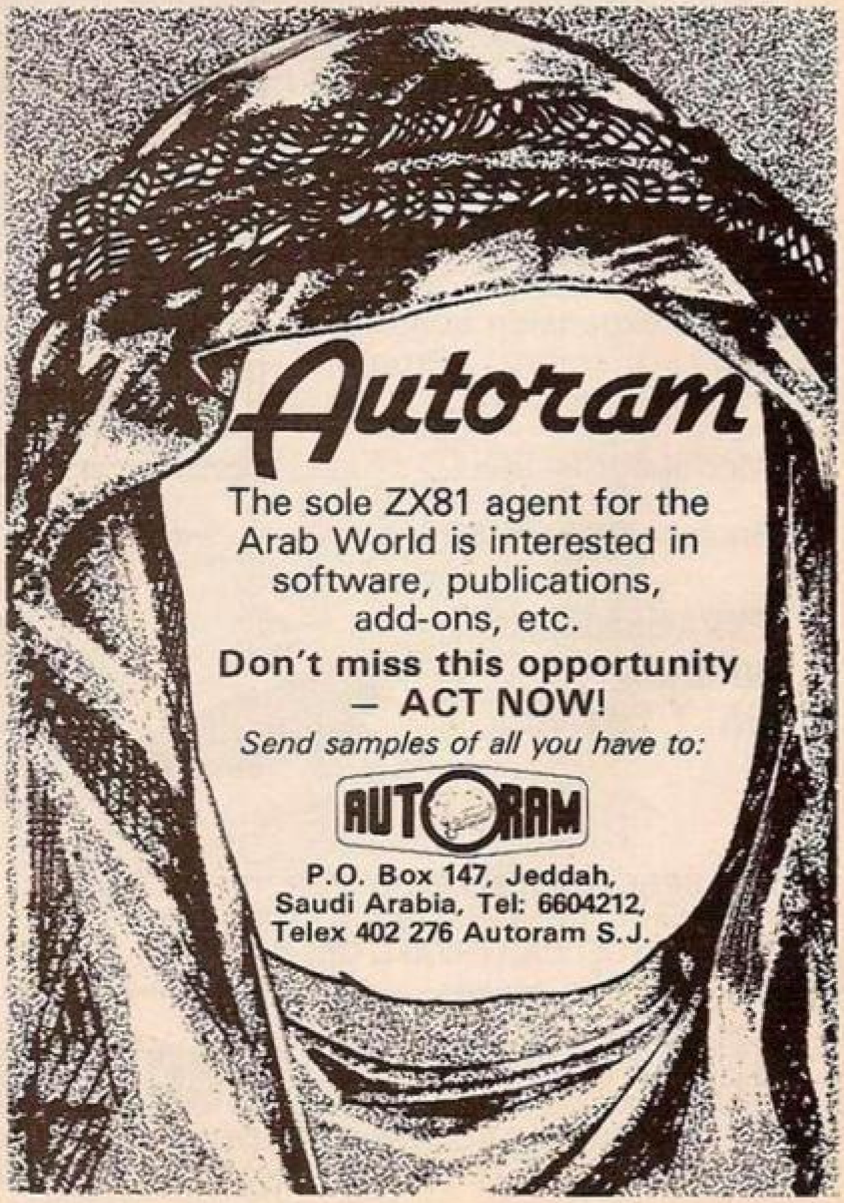
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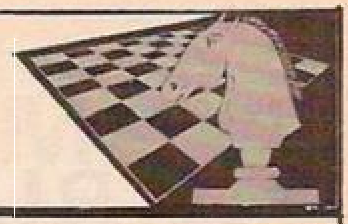
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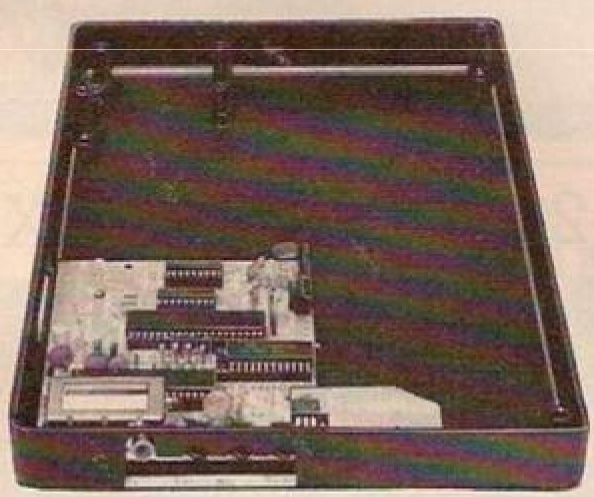
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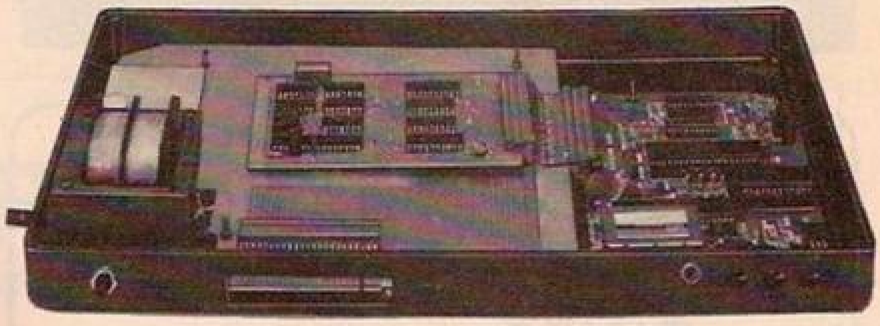


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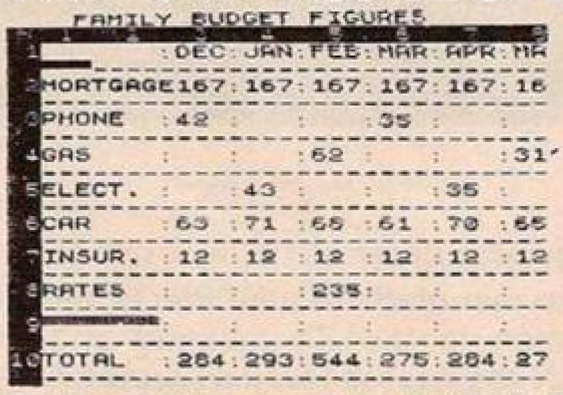
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3	PHONE	42			35		
4	GAS			62			31
5	ELECT.		43			35	
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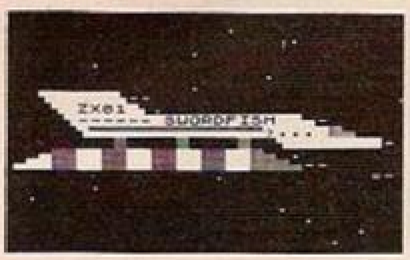
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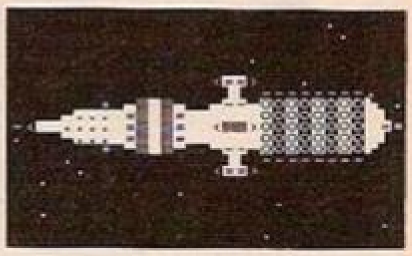
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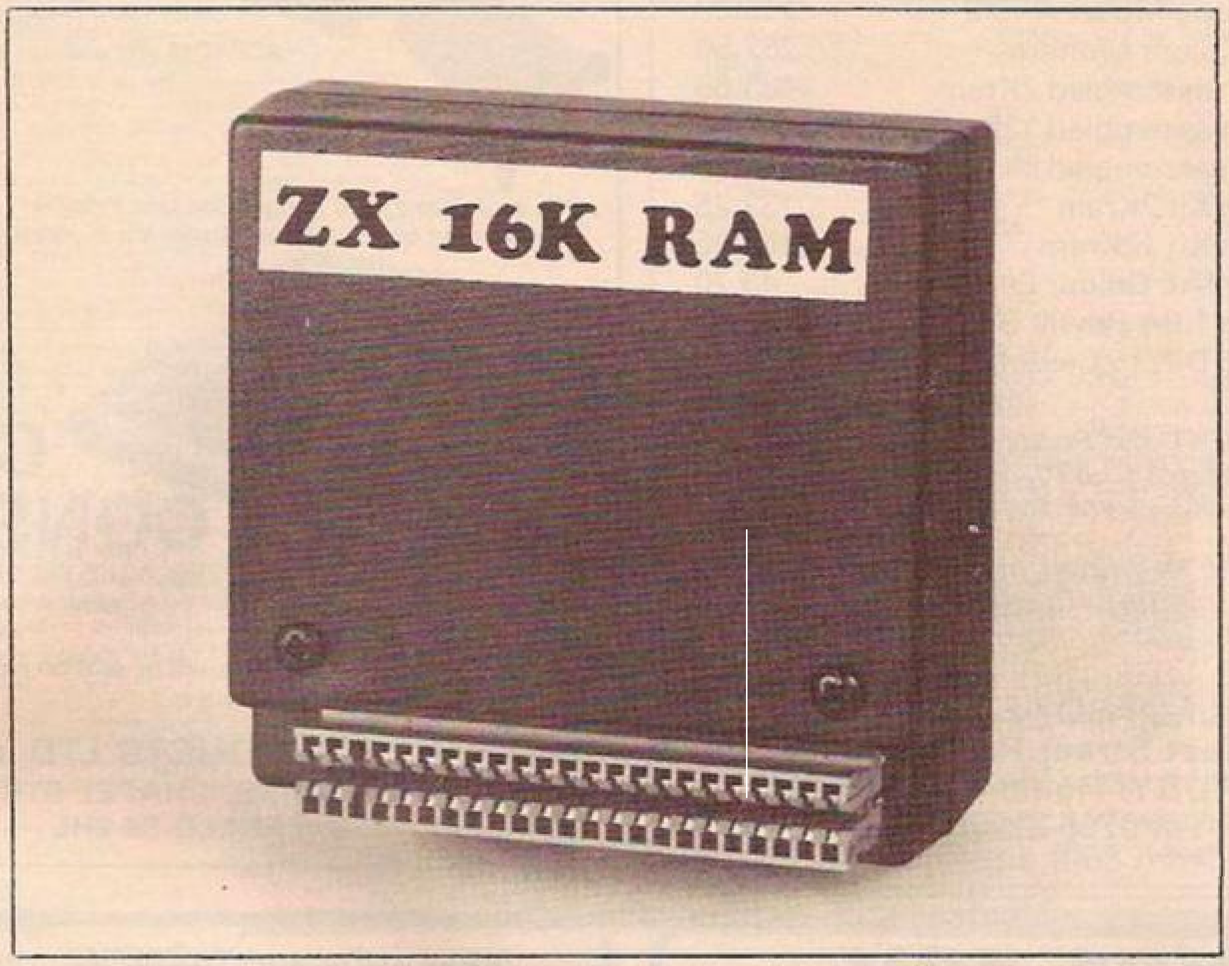
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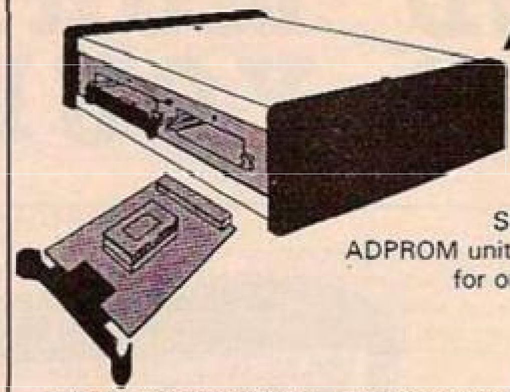
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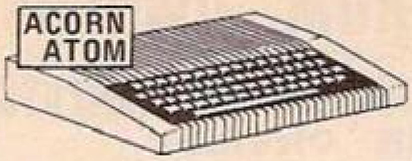
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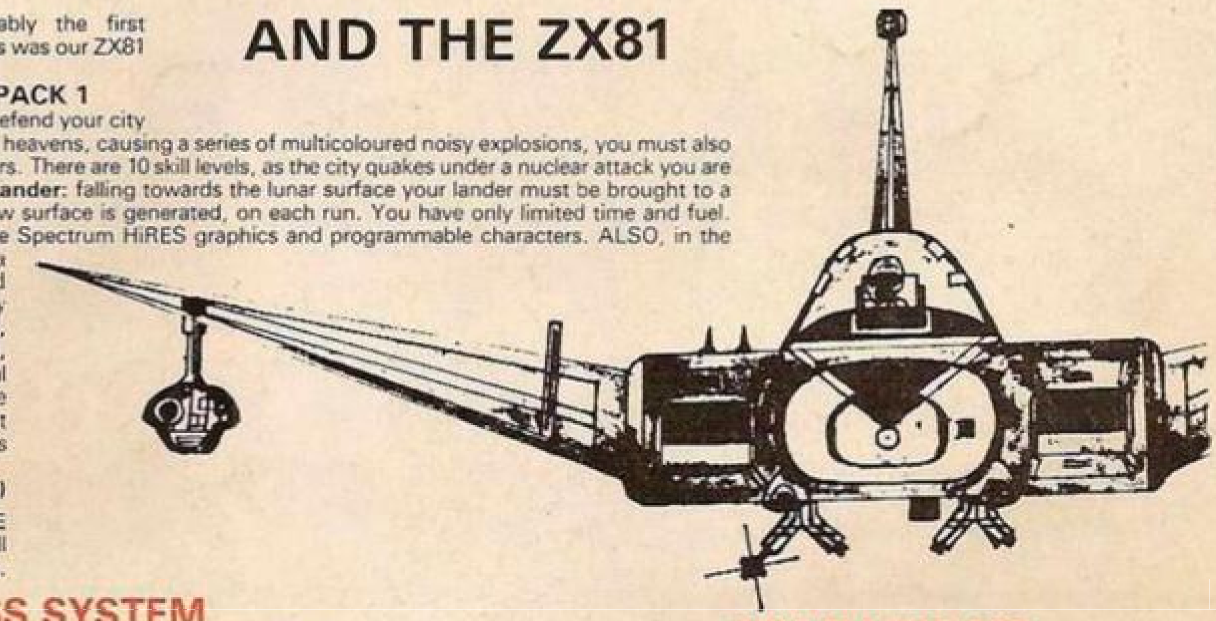
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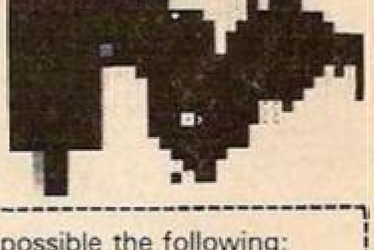
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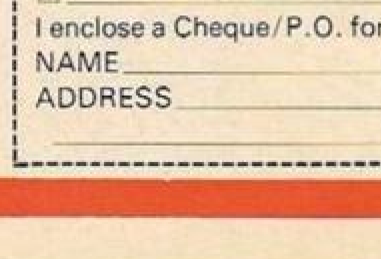
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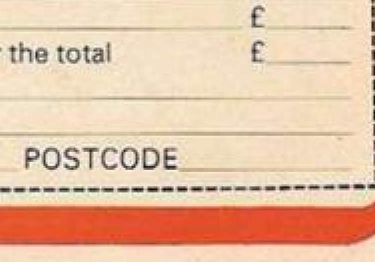
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